Monash Centre for Electron Microscopy (MCEM)

User Manual 2019

PQMS3-MCEM-REF-0005-V2
Front cover photograph taken by Trevor Mein.
Contents
INTRODUCTION ........................................................ ...................................................... 7
ABOUT MCEM ........................................................ ..................................................... 7
 MCEM Platform Vision .................................................................................................................. 7
 MCEM Platform Mission ................................................................................................................... 7
STAFF CONTACT DETAILS AND ROLES .......................................................... 8
 General Office ........................................................................................................................................... 8
 Director .................................................................................................................................................... 8
 Manager .................................................................................................................................................. 8
 MCEM Web Page .................................................................................................................................. 8
 Email ........................................................................................................................................................ 8
 Academic Staff ........................................................................................................................................... 9
 Microscope Managers ............................................................................................................................. 10
 Microscopists ........................................................................................................................................ 11
 Microscope Engineers ............................................................................................................................. 12
 Affiliates .................................................................................................................................................. 13
 Affiliated Monash Academic and Research Staff ......................................................................................... 13
 Current Alexander Moodie Scholarship Holders ......................................................................................... 13
 Past Alexander Moodie Scholarship Holders ............................................................................................. 14
LOCATION ........................................................ ............................................................ 15
 Toilets .................................................................................................................................................... 17
 Smoke-free Campus ............................................................................................................................... 17
BUILDING ACCESS ........................................................ ............................................... 21
 Laboratory Area Access ........................................................................................................................... 21
 Visitors .................................................................................................................................................... 22
 After-Hours Access ............................................................................................................................... 22
 Use of Monash ID Cards ........................................................................................................................... 22
 Staff ....................................................................................................................................................... 22
 Students .................................................................................................................................................. 23
 Tours ....................................................................................................................................................... 24
 Guest Wireless ....................................................................................................................................... 24
INSTRUMENTATION AND SUPPORT FACILITIES ......................................................... 25
EQUIPMENT MANAGERS, ENGINEERS AND TRAINERS ................................................. 30
Room in use light ................................................................................................................................. 44
SAFETY RULES AND LABORATORY PROCEDURES ................................................................. 45
OHS Induction ......................................................................................................................................... 45
Visitors or client users under supervision at all times ................................................................. 46
Contractors working under supervision at all times ........................................................................... 46
Buildings and Properties staff and contractors .................................................................................. 46
Computer room only users .................................................................................................................... 46
Additional OHS training ......................................................................................................................... 46
General Rules......................................................................................................................................... 46
After-Hours Operation .......................................................................................................................... 47
Security Procedure ............................................................................................................................... 47
Personal Protective Clothing And Equipment ......................................................................................... 47
Laboratory Use ......................................................................................................................................... 48
Fume Cupboards ................................................................................................................................. 48
Samples And Chemicals .......................................................................................................................... 49
Engineered Nanoparticles (ENPs) .......................................................................................................... 50
Handling ENPs ......................................................................................................................................... 50
Emergency Stop Buttons ......................................................................................................................... 50
UPS Power ............................................................................................................................................... 50
SF\textsubscript{6} Sensors And Alarms ........................................................................................................... 50
Oxygen Sensors And Alarms .................................................................................................................... 51
Liquid Nitrogen ......................................................................................................................................... 51
Compressed Gases ................................................................................................................................. 51
Hazards And Incidents/Chemical Spills/Breakages ............................................................................... 52
Ionising radiation ...................................................................................................................................... 52
EMERGENCY EVACUATION .................................................................................................................. 53
Power Failure ........................................................................................................................................... 53
IN AN EMERGENCY ................................................................................................................................. 54
Contacting emergency services ............................................................................................................. 54
Fire Extinguisher Locations ..................................................................................................................... 54
Emergency Eye Wash And Showers ........................................................................................................ 54
Emergency Evacuation Plan ..................................................................................................................... 55
Safety Officers .......................................................................................................................................... 56
Health and Safety Representative ............................................................................................................. 56
INTRODUCTION

This Manual is a convenient reference giving information about the Monash Centre for Electron Microscopy (MCEM), its staff and facilities, operating procedures and occupational health and safety matters.

If you have any questions or comments regarding the Manual or MCEM, please contact the Manager, Dr Peter Miller (see contact details below).

ABOUT MCEM

MCEM is a central university research Platform. Monash University has a strong, integrated network of world-class technology research platforms. These are made up of core facilities and capabilities that provide high-quality specialist research services (see monash.edu/research/infrastructure).

The Monash technology research platforms are coordinated through the Office of the Pro Vice-Chancellor (Research and Research Infrastructure).

MCEM Platform Vision

To be at the forefront of research in electron microscopy, providing a leading edge capability that will enable researchers to solve major scientific challenges.

MCEM Platform Mission

To enable and advance research excellence at Monash University and beyond through the provision of world-class microscopy for the determination of the structure of matter down to the atomic scale.

MCEM achieves this via its dual academic and research support role, namely:

1. execution of world class research in the field of electron microscopy, and
2. provision of advanced instrumentation, expertise and training in electron microscopy to researchers across all fields of science and engineering (except biology).

MCEM is the largest electron microscope facility in Victoria, serving several hundred registered researchers from Monash, other universities, government research agencies, as well as providing consultancy services to industry. It plays an important role in educating/supporting students in electron microscopy and materials characterisation and is a key complementary facility to the Australian Synchrotron and the Melbourne Centre for Nanofabrication (MCN), the Australian National Fabrication Facility’s (ANFF) central node in Victoria. MCEM works closely with The Monash Ramaciotti Centre for Cryo-Electron Microscopy and Monash Micro Imaging (MMI) which provide optical and electron microscopy facilities for the biological sciences.

MCEM maintains eight electron microscopes: four transmission electron microscopes (TEM); three scanning electron microscopes (SEM) and a Focused ion beam/ scanning electron microscope (FIB/SEM).

Four major new instruments were commissioned in 2008/2009, including Australia’s first “aberration-corrected” transmission electron microscope, the FEI Titan³ 80-300 field emission gun transmission electron microscope (FEGTEM). The other three instruments are the JEOL 2100F FEGTEM, JEOL 7001F FEGSEM and an FEI Quanta 3D FIB/FEGSEM. A further four instruments were installed in 2012: FEI Nova NanoSEM 450 FEGSEM; FEI Magellan 400 FEGSEM; FEI Tecnai G2 T20 TWIN TEM and FEI Tecnai G2 F20 S-TWIN FEGTEM.

To learn more about MCEM please visit our website: www.mcem.monash.edu/.
STAFF CONTACT DETAILS AND ROLES

**General Office**
Ms Katherine O'Rourke
Executive Assistant
Tel.: 990 55563
Office: 10 Innovation Walk Room G03
katherine.orourke@monash.edu

Ms Catherine Brown
Executive Assistant
Tel.: 990 55563
Office: 10 Innovation Walk Room G03
katherine.orourke@monash.edu

**Director**
Professor Joanne Etheridge
Director
Tel.: 990 51836
Office: 10 Innovation Walk Room G05
joanne.etheridge@monash.edu

**Manager**
Dr Peter Miller
Manager
Tel.: 990 55291       Mobile: 0418 123 584
Office: 10 Innovation Walk Room G06
peter.miller@monash.edu

**MCEM Web Page**
mcem.monash.edu/

**Email**
mcem@monash.edu
**Academic Staff**

Academic Staff members conduct their own research programmes, usually in the development of advanced methods of electron microscopy and their application to the study of materials. They may collaborate with Users on projects of mutual interest requiring advanced electron microscopy. Academic Staff are responsible for leading the development of new methods and instrumentation to maintain and extend the MCEM’s advanced capabilities. Academic Staff members also perform the role of Microscope Manager (see below).

Professor Joanne Etheridge  
Director  
Tel.: 990 51836  
Office: 10 Innovation Walk Room G05  
joanne.etheridge@monash.edu

Associate Professor Laure Bourgeois  
Associate Professor and JEOL 2100F FEGTEM Manager  
Tel.: 990 55368  
Office: 10 Innovation Walk Room 105  
laurie.bourgeois@monash.edu

Associate Professor Matthew Weyland  
Associate Professor and FEI Titan FEGTEM Manager  
Tel.: 990 59026  
Office: 10 Innovation Walk Room 108  
matthew.weyland@monash.edu
Microscope Managers

The Microscope Manager is responsible for:

- overall management of a microscope, its performance and maintenance;
- preparation of operating manuals and training materials;
- management of training, client work (internal and external) and issuing licences;
- setting and enforcing training procedures, operating procedures, access rules and booking regimes;
- instrument and technique development;
- provision of expert advice to assist with equipment purchase.

The Microscope Manager provides training, advice and assistance to Users, particularly where advanced techniques are needed. The Microscope Manager may collaborate with Users on projects of mutual interest and may carry out Client work.

Microscope Managers work closely with Microscopists to ensure the efficient operation of the laboratory.

Dr Xi-Ya Fang
SEM Manager (FEI Magellan 400 FEGSEM, FEI Nova NanoSEM 450 FEGSEM and JEOL 7001F FEGSEM)
Tel.: 990 20821
Office: 10 Innovation Walk Room 107
xi-ya.fang@monash.edu

Dr Amelia Liu
FIB Manager (FEI Quanta 3D FIB FEGSEM)
Tel.: 990 58789
Office: 10 Innovation Walk Room 106
amelia.liu@monash.edu

Dr Tim Williams
TEM Manager (FEI Tecnai G2 T20 TWIN TEM and FEI Tecnai G2 F20 S-TWIN FEGTEM)
Tel.: 990 20721
Office: 10 Innovation Walk Room 103
timothy.williams@monash.edu
**Microscopists**

Microscopists work closely with Microscope Managers to support the efficient operation of the laboratory. They assist with the development of training and operating procedures and with development of new microscope capabilities and techniques. Microscopists provide training and assistance to microscope Users, may collaborate with Users on projects of mutual interest and carry out Client work.

Dr Emily Chen  
Electron Microscopist and Sample Preparation Specialist  
Tel.: 990 55348  
Office: 10 Innovation Walk Room 104  
yu.chen@monash.edu

Dr Kallista Sears (Casual)  
Electron Microscopist  
Tel.: 990 56211  
Office: 10 Innovation Walk Room G29  
kallista.sears@monash.edu

Nick McDougall (Casual)  
Electron Microscopist  
Tel.: 990 56250  
Office: 10 Innovation Walk Room G29  
Nick.McDougall@monash.edu

Dr Zhou (Ben) Xu  
Electron Microscopist  
Tel.: 990 56211  
Office: 10 Innovation Walk Room 104  
zhou.xu@monash.edu
**Microscope Engineers**

Microscope Engineers play a pivotal role in the day-to-day running of the laboratories. They undertake maintenance on specific instrumentation and associated infrastructure (see Table 5) and may be involved in the further development of these instruments to optimise and extend performance. Microscope Engineers provide training and assistance to microscope Users, (see Table 5) and may carry out Client work. They are usually your first point of contact when a problem is encountered with an instrument.

Dr Russell King  
Electron Microscope Engineer and Safety Officer  
Tel.: 990 53804  
Office: 10 Innovation Walk Room G34  
russell.king@monash.edu

Mr Renji Pan  
Electron Microscope Engineer  
Tel.: 990 54931  
Office: 10 Innovation Walk Room G34  
renji.pan@monash.edu

David Vowles (visiting)  
Electron Microscope Engineer  
Tel.: 990 53435  
Office: 10 Innovation Walk Room G29  
david.vowles@monash.edu
Affiliates

Affiliates typically hold a joint appointment with MCEM and a School or Department. They conduct their own programmes of research, usually in the development of methods of microscopy and their application to the study of materials. They may be available to collaborate with Users on projects of mutual interest requiring advanced microscopy. They are not routinely involved in microscope management, training or service.

Affiliated Monash Academic and Research Staff

A number of Monash academic and research staff have specialist research programmes in the development of electron microscopy methods.

<table>
<thead>
<tr>
<th>Name</th>
<th>Position and Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr Espen Bøjesen</td>
<td>Villum Postdoctoral Research Fellow MCEM</td>
</tr>
<tr>
<td>Dr Hamish Brown</td>
<td>Research Fellow, School of Physics and Astronomy</td>
</tr>
<tr>
<td>Dr Heidi Cheng</td>
<td>Postdoctoral Research Fellow Department of Materials Science and Engineering</td>
</tr>
<tr>
<td>Dr Laura Clark</td>
<td>Research Fellow, School of Physics and Astronomy</td>
</tr>
<tr>
<td>Dr Scott Findlay</td>
<td>QE11 Research Fellow and Senior Lecturer School of Physics and Astronomy</td>
</tr>
<tr>
<td>Dr Jing Fu</td>
<td>Senior Lecturer, Mechanical and Aerospace Engineering</td>
</tr>
<tr>
<td>Mr Yueming Guo</td>
<td>Research Fellow, Department of Materials Science and Engineering</td>
</tr>
<tr>
<td>Dr Matus Krajnak</td>
<td>Research Fellow Department of Materials Science and Engineering</td>
</tr>
<tr>
<td>A/Prof. Philip Nakashima</td>
<td>Future Fellow Department of Materials Science and Engineering</td>
</tr>
<tr>
<td>Dr Tim Petersen</td>
<td>Research Fellow School of Physics and Astronomy</td>
</tr>
<tr>
<td>Prof. Ray Withers</td>
<td>MCEM Adjunct</td>
</tr>
</tbody>
</table>

Current Alexander Moodie Scholarship Holders

<table>
<thead>
<tr>
<th>Name</th>
<th>Department of Materials Science and Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ms Wei Chao</td>
<td>Department of Materials Science and Engineering</td>
</tr>
<tr>
<td>Mr Weilun Li</td>
<td>Department of Materials Science and Engineering</td>
</tr>
<tr>
<td>Ma Xiaofen Tan</td>
<td>Department of Materials Science and Engineering</td>
</tr>
</tbody>
</table>
### Past Alexander Moodie Scholarship Holders

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr Yueming Guo</td>
<td>Department of Materials Science and Engineering</td>
</tr>
<tr>
<td>Mr Tianyu Liu</td>
<td>Department of Materials Science and Engineering</td>
</tr>
<tr>
<td>Dr Dan Nguyen</td>
<td>Department of Materials Science and Engineering</td>
</tr>
<tr>
<td>Dr Zezhong Zhang</td>
<td>Department of Materials Science and Engineering</td>
</tr>
<tr>
<td>Ms Yunhe Zheng</td>
<td>Department of Materials Science and Engineering</td>
</tr>
</tbody>
</table>
LOCATION
The Monash Centre for Electron Microscopy is located at 10 Innovation Walk on the Monash University Clayton campus, (see Figure 1). The main entrance is at the North-West corner.

For general information about the Monash Clayton campus see: https://www.monash.edu/about/our-locations/clayton-campus

For information on travelling to the Clayton campus and parking advice see: monash.edu/people/transport-parking

Figure 1. The Monash Centre for Electron Microscopy is located at 10 Innovation Walk on the Monash University Clayton campus, see also https://www.monash.edu/people/maps.
BUILDING DIRECTORY

Plans of the ground floor and mezzanine level are shown in Figure 2 and Figure 3 respectively. The Centre’s room directory and telephone list is given in Table 1.

Figure 2. MCEM, 10 Innovation Walk (Building 81) ground level.
Figure 3. MCEM, 10 Innovation Walk (Building 81) mezzanine level.

**Toilets**

Male, Disabled and Female toilets are located in the administration area at the North end of the building (top of the plan), Rooms G07, G08 and G09 respectively. The unisex toilet located on the mezzanine level, Room 109 is for MCEM staff use only.

**Smoke-free Campus**

Monash is a smoke-free University, see [https://www.monash.edu/ohs/health-and-wellbeing/smoke-free-monash](https://www.monash.edu/ohs/health-and-wellbeing/smoke-free-monash).
<table>
<thead>
<tr>
<th>Room Number</th>
<th>Description</th>
<th>Telephone</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>G02</td>
<td>Monash Centre for Electron Microscopy</td>
<td>990 58774</td>
<td>Main entrance</td>
</tr>
<tr>
<td>G03/G04</td>
<td>MCEM General Office</td>
<td>990 55563</td>
<td>MCEM staff only</td>
</tr>
<tr>
<td></td>
<td>Ms Katherine O'Rourke</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Executive Assistant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G05</td>
<td>Prof. Joanne Etheridge</td>
<td>990 51836</td>
<td>Office</td>
</tr>
<tr>
<td></td>
<td>MCEM Director</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G06</td>
<td>Dr Peter Miller</td>
<td>990 55291</td>
<td>Office</td>
</tr>
<tr>
<td></td>
<td>MCEM Manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G07</td>
<td>Male Toilet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G08</td>
<td>Unisex Toilet and Shower</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G09</td>
<td>Female Toilet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G10</td>
<td>Tea Room</td>
<td>990 58781</td>
<td></td>
</tr>
<tr>
<td>G11</td>
<td>Meeting Room</td>
<td>990 58782</td>
<td></td>
</tr>
<tr>
<td>G15</td>
<td>TEM Laboratory Lobby</td>
<td>990 58783</td>
<td>Licensed users only</td>
</tr>
<tr>
<td></td>
<td>FEI Tecnai T20</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FEI Tecnai F20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G16</td>
<td>Utility Room (Laboratory G17)</td>
<td></td>
<td>MCEM staff only</td>
</tr>
<tr>
<td>G17</td>
<td>FEI Tecnai G2 F20 F-TWIN FEGTEM</td>
<td>990 51834</td>
<td>Licensed users only</td>
</tr>
<tr>
<td>G18</td>
<td>FEI Tecnai G2 T20 TWIN TEM</td>
<td>990 59891</td>
<td>Licensed users only</td>
</tr>
<tr>
<td>G19</td>
<td>Utility Room (Laboratory G18)</td>
<td></td>
<td>MCEM staff only</td>
</tr>
<tr>
<td>G20</td>
<td>FEGTEM Operators’ Room</td>
<td>990 58784</td>
<td>FEGTEM licensed users</td>
</tr>
<tr>
<td></td>
<td>FEI Titan FEGTEM</td>
<td></td>
<td>only</td>
</tr>
<tr>
<td></td>
<td>JEOL 2100F FEGTEM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G21</td>
<td>FEI Titan FEGTEM</td>
<td>990 58785</td>
<td>Licensed users only</td>
</tr>
<tr>
<td>G21A</td>
<td>Utility Room (Laboratory G21)</td>
<td></td>
<td>MCEM staff only</td>
</tr>
<tr>
<td>G22</td>
<td>Utility Room (FEGTEMs)</td>
<td></td>
<td>MCEM staff only</td>
</tr>
<tr>
<td>G23</td>
<td>JEOL 2100F FEGTEM</td>
<td>990 58786</td>
<td>2100F licensed users</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>only</td>
</tr>
<tr>
<td>G24</td>
<td>Cleaner’s cupboard</td>
<td></td>
<td>Cleaner only</td>
</tr>
<tr>
<td>G25</td>
<td>Focused Ion Beam Microscope Lobby</td>
<td>990 58787</td>
<td>Licensed users only</td>
</tr>
<tr>
<td>G26</td>
<td>Focused Ion Beam Microscope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Room Number</td>
<td>Description</td>
<td>Telephone</td>
<td>Comments</td>
</tr>
<tr>
<td>-------------</td>
<td>------------------------------------</td>
<td>-------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>G27</td>
<td>Specimen Preparation Laboratory B</td>
<td>990 58788</td>
<td>MCEM staff and licensed users only</td>
</tr>
<tr>
<td>G28A</td>
<td>Utility Room (Laboratory G26)</td>
<td></td>
<td>MCEM staff only</td>
</tr>
<tr>
<td>G29</td>
<td>Casual Electron Microscopists</td>
<td>990 53435</td>
<td>Office</td>
</tr>
<tr>
<td>G30</td>
<td>Microtome Laboratory</td>
<td>990 58790</td>
<td>Licensed users only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>990 20822</td>
<td></td>
</tr>
<tr>
<td>G31</td>
<td>TEM Support Laboratory</td>
<td>990 58777</td>
<td>TEM licensed users only</td>
</tr>
<tr>
<td>G32</td>
<td>Polishing Room</td>
<td>990 20717</td>
<td>TEM licensed users only</td>
</tr>
<tr>
<td>G33</td>
<td>Clean Workroom</td>
<td>990 20718</td>
<td>MCEM staff only</td>
</tr>
<tr>
<td>G34</td>
<td>Dr Russell King Microscope Engineer</td>
<td>990 53804</td>
<td>Office</td>
</tr>
<tr>
<td></td>
<td>Safety Officer</td>
<td>990 54931</td>
<td></td>
</tr>
<tr>
<td>G35</td>
<td>Specimen Preparation Laboratory A</td>
<td>990 54905</td>
<td>All licensed users</td>
</tr>
<tr>
<td>G36</td>
<td>JEOL 7001F FEGSEM</td>
<td>990 20702</td>
<td>Licensed users only</td>
</tr>
<tr>
<td>G37</td>
<td>Electropolishing Laboratory</td>
<td>990 20701</td>
<td>Electropolisher licensed users only</td>
</tr>
<tr>
<td>G38</td>
<td>Liquid Nitrogen and Gas Store</td>
<td>990 20701</td>
<td>All licensed users</td>
</tr>
<tr>
<td>G41</td>
<td>FEI Nova NanoSEM 450 FEGSEM</td>
<td>990 20704</td>
<td>Licensed users only</td>
</tr>
<tr>
<td>G42</td>
<td>FEI Magellan 400 FEGSEM</td>
<td>990 20703</td>
<td>Licensed users only</td>
</tr>
<tr>
<td>G43</td>
<td></td>
<td>990 20719</td>
<td>Licensed users only</td>
</tr>
<tr>
<td>G44</td>
<td>Utility Room (Laboratory G43)</td>
<td></td>
<td>MCEM staff only</td>
</tr>
<tr>
<td>G45</td>
<td>Utility Room (Laboratory G42)</td>
<td></td>
<td>MCEM staff only</td>
</tr>
<tr>
<td>G46</td>
<td>Utility Room (Laboratory G41)</td>
<td></td>
<td>MCEM staff only</td>
</tr>
<tr>
<td>G47</td>
<td>Utility Room (Laboratory G46)</td>
<td></td>
<td>MCEM staff only</td>
</tr>
<tr>
<td>102</td>
<td>Computer Room</td>
<td>990 20723</td>
<td>All licensed users</td>
</tr>
<tr>
<td>103</td>
<td>Dr Tim Williams Tecnai TEM Manager</td>
<td>990 20721</td>
<td>Office</td>
</tr>
<tr>
<td>104</td>
<td>Dr Emily Chen Electron Microscopist</td>
<td>990 55348</td>
<td>Office</td>
</tr>
<tr>
<td></td>
<td>Dr Zhou (Ben) Xu Electron Microscopist</td>
<td>990 56211</td>
<td></td>
</tr>
<tr>
<td>Room Number</td>
<td>Description</td>
<td>Telephone</td>
<td>Comments</td>
</tr>
<tr>
<td>-------------</td>
<td>------------------------------------</td>
<td>------------</td>
<td>-----------</td>
</tr>
<tr>
<td>105</td>
<td>Assoc. Prof. Laure Bourgeois</td>
<td>990 55368</td>
<td>Office</td>
</tr>
<tr>
<td></td>
<td>JEOL 2100F TEM Manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td>106</td>
<td>Dr Amelia Liu</td>
<td>990 58789</td>
<td>Office</td>
</tr>
<tr>
<td></td>
<td>FIB Manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td>107</td>
<td>Dr Xi-Ya Fang</td>
<td>990 20821</td>
<td>Office</td>
</tr>
<tr>
<td></td>
<td>SEM Manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td>108</td>
<td>Assoc. Prof. Matthew Weyland</td>
<td>990 59026</td>
<td>Office</td>
</tr>
<tr>
<td></td>
<td>Titan Manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td>109</td>
<td>Unisex Toilet</td>
<td></td>
<td>MCEM staff only</td>
</tr>
<tr>
<td>110</td>
<td>Research Fellows Office</td>
<td></td>
<td>Office</td>
</tr>
</tbody>
</table>
BUILDING ACCESS
The main MCEM entrance is open from 8:45am to 5:30pm on normal University business days. This gives access to the General Office, Director's Office, Manager's Office, Kitchen, toilets and the Meeting Room.

Laboratory Area Access
Access to the main laboratory area is restricted. Authorised Centre Users can use their Monash ID card to enter the Laboratory Area via the door in Reception from 8:45am to 5:30pm on normal University business days. Please contact the General Office if you change your ID card so that we can contact Security to activate your new card.

Business Hours bookings on microscopes can be made between 9:00am and 5:00pm on normal university working days.

*Only authorized personnel may enter a given room in the Laboratory Area unsupervised.* A list of authorized personnel is provided outside each room in the Laboratory Area. Room access rights are summarised in Table 2.

Table 2. Summary of room access rights.

<table>
<thead>
<tr>
<th>Room</th>
<th>Authorized personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microscope Laboratories</td>
<td>Licensed microscope users.</td>
</tr>
<tr>
<td>Specimen Preparation Laboratory A</td>
<td>All licensed microscope users.</td>
</tr>
<tr>
<td>Gas Store</td>
<td>Must have completed cryogenics induction.</td>
</tr>
<tr>
<td>Computer Room</td>
<td>All licensed users.</td>
</tr>
<tr>
<td>TEM Support Laboratory</td>
<td>All licensed TEM users.</td>
</tr>
<tr>
<td>Polishing Room</td>
<td>People licensed to use saws, grinding or polishing equipment.</td>
</tr>
<tr>
<td>Ultramicrotome Laboratory</td>
<td>Licensed ultramicrotome users.</td>
</tr>
<tr>
<td>Electropolishing Laboratory</td>
<td>Proximity card access. Licensed electropolishing users only.</td>
</tr>
<tr>
<td>Specimen Preparation Laboratory B</td>
<td>People licensed to use equipment in this room.</td>
</tr>
<tr>
<td>All Utility Rooms</td>
<td>MCEM staff only.</td>
</tr>
<tr>
<td>Clean Workroom</td>
<td>MCEM staff only.</td>
</tr>
</tbody>
</table>
Visitors
Visitors to the main laboratory area must sign in and out at Reception, must wear a Visitor Badge and must be under the supervision of an authorised MCEM User at all times. Visitors are not permitted to use any MCEM equipment. If you allow a Visitor to use MCEM equipment your access to MCEM will be revoked.

Visitors wishing to enter the laboratory area for a meeting with a staff member or affiliate must wait in Reception until they are picked up. Visitors should ring the staff member or affiliate to announce their arrival. A telephone and staff telephone list are available in Reception for use if the General Office is unattended.

After-Hours Access
An After-Hours licence may be granted once a microscope user has achieved a sufficient level of skill to be able to operate the microscope independently. Additional training is provided to allow the User to correctly rectify minor issues should these arise after hours when MCEM staff are not available. A minimum of six months regular, trouble free microscope use is needed before a User may apply to the Microscope Manager for consideration for an After-Hours licence. After-Hours access is only available to Monash staff and students.

Users with an After-Hours licence have 24-hour access to the relevant laboratories on normal University working days via the main entrance and the door from Reception into the Laboratory Area.

For further information on After-Hours procedures access please see page 47.

Use of Monash ID Cards
Monash Staff and students must not allow any other person to use their Monash University ID card. To do so is an extremely serious matter which could amount to conduct capable of disciplinary action. Staff and students who become aware of such misuse must immediately report the matter.

An MCEM User is not permitted to let anyone else into the laboratory area except for visitors under their direct supervision. This includes another MCEM User who didn’t bring their ID card or someone who sneaks in behind while the door is open. Anyone without an ID card must contact an MCEM staff member who will check that they are a current User before letting them enter the laboratory area. In some special cases such as when a card is lost or damaged a fob may be provided for temporary use.

The following advice on the use of Monash ID cards has been provided by the Monash Office of the General Counsel.

Staff
Staff must not allow any other person to use their Monash University ID card. To do so is an extremely serious matter which would be in breach of:

- the staff's employment contract. All staff employment contracts include a term requiring staff to comply with any obligations imposed by University policies and procedures. It is each staff member's responsibility to keep themselves informed of University policies and procedures at all times;
- the Access to Controlled Areas Policy (see http://www.policy.monash.edu/policy-bank/management/facilities-services/access-to-controlled-areas-policy.html). This policy applies to all staff and students of Monash. All persons to whom an access control card
has been issued must only use the card to enter areas of campus for which they are currently authorised. Access cards must be used only by the person to whom they have been issued. They must not be lent, given to, or used by any other person to enter a controlled area for which they have no authorised right of entry. Anyone possessing or using an access control card to enter University premises without authorisation will be subject to disciplinary actions from the University or criminal charges where appropriate; and

- the terms upon which access was issued. MCEM licensees are required to sign the Safety Inductions Checklist and User Agreement attached to the MCEM User Manual, where licensees agree (amongst other things) that they have read and understood the Manual, to follow the MCEM rules and procedures at all times and that only authorised personnel (Licensed Users) may enter a laboratory unsupervised.

The above mentioned breaches are extremely serious matters and could amount to conduct capable of disciplinary action or dismissal under the Monash University Enterprise Agreement.

**Students**

Students **must not** allow any other person to use their Monash University ID card. To do so is an extremely serious matter which would be in breach of:

- the *Monash University (Council) Regulations*. Students are bound by University statute as a matter of law. When students enrol on the Web Enrolment System they also acknowledge and agree that they are bound by the statutes, regulations, policies and procedures of the University as amended from time to time. Regulation 30(2) states that a student who commits, or attempts to commit, or assists or encourages another student to commit, an act of general misconduct, academic misconduct or research misconduct commits a misconduct offence. General misconduct is conduct that is contrary to accepted standards of behaviour and includes conduct by which a student knowingly or recklessly breaches a University statute or a University regulation or a published policy or procedure of the University. A member of staff of the University who has reasonable grounds to believe that a student has committed an act of misconduct must report the matter to the responsible officer. General misconduct by a student is a serious matter which can result in disciplinary action and penalties, including exclusion from the University.

- the Access to Controlled Areas Policy (see [http://www.policy.monash.edu/policy-bank/management/facilities-services/access-to-controlled-areas-policy.html](http://www.policy.monash.edu/policy-bank/management/facilities-services/access-to-controlled-areas-policy.html)). This policy applies to all staff and students of Monash. All persons to whom an access control card has been issued must only use the card to enter areas of campus for which they are currently authorised. Access cards must be used only by the person to whom they have been issued. They must not be lent, given to, or used by any other person to enter a controlled area for which they have no authorised right of entry. Anyone possessing or using an access control card to enter University premises without authorisation will be subject to disciplinary actions from the University or criminal charges where appropriate; and

- the terms upon which access was issued. MCEM licensees are required to sign the Safety Inductions Checklist and User Agreement attached to the MCEM User Manual, where licensees agree (amongst other things) that they have read and understood the Manual, to follow the MCEM rules and procedures at all times and that only authorised personnel (Licensed Users) may enter a laboratory unsupervised.
The above mentioned breaches are extremely serious matters and could amount to conduct capable of disciplinary action or exclusion from the University under the Monash University (Council) Regulations.

**Tours**

MCEM is a key research capability within Monash University and we frequently receive requests for tours. Tours of MCEM are important and we try to accommodate these requests while minimising any disruption to MCEM users. If you would like to arrange a tour of MCEM, please send a request to the Manager, preferably at least one week in advance. Please note that microscopes are heavily booked and that microscope doors are kept closed. Microscope operators have limited time to get their work done and cannot be interrupted. The earlier that MCEM is notified of a tour, the greater the chance that the tour will be able to include a visit to the major instruments.

**Guest Wireless**

Monash has three wireless networks available.

- Eduroam – for Monash staff and students and visitors from other eduroam institutions.
- Guest-wireless – for registered Monash visitors who have a temporary Monash account.
- Monash Free WiFi – open access for the general public on all Australian campuses. This network is not encrypted.

For further information see http://www.monash.edu/wireless.
INSTRUMENTATION AND SUPPORT FACILITIES

MCEM relocated into the new building, 10 Innovation Walk (Building 81), in November 2007. This dedicated building provides exceptional acoustic, mechanical, thermal and electromagnetic stability as well as high quality water, gas and power services needed to ensure optimum instrument performance. This is one of the most stable electron microscopy buildings worldwide.

MCEM maintains eight electron microscopes: four transmission electron microscopes (TEM); three scanning electron microscopes (SEM) and a Focused ion beam/field emission gun scanning electron microscope (FIB/FEGSEM). Two atom probe field ion microscopes (APFIM) were removed from service at the end of 2014.

Four major new instruments were commissioned in 2008/2009, including Australia’s first “aberration-corrected” transmission electron microscope, the FEI Titan³ 80-300 field emission gun transmission electron microscope (FEGTEM). This is the highest resolution microscope in Australia and one of just a handful worldwide. The other three instruments are the JEOL 2100F FEGTEM, JEOL 7001F FEGSEM and an FEI Quanta 3D FIB/FEGSEM. A further four new instruments were installed during the second half of 2012: FEI Nova NanoSEM 450 FEGSEM; FEI Magellan 400 FEGSEM; FEI Tecnai G2 T20 TWIN TEM; FEI Tecnai G2 F20 S-TWIN FEGTEM.

Computer software and support equipment are listed in Table 3 and Table 44.

Table 3. MCEM software and computers.

<table>
<thead>
<tr>
<th>Software</th>
<th>Computer platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amira v5, several copies</td>
<td>PC</td>
</tr>
<tr>
<td>Bruker Esprit V1.9 and V2.1 EDS X-ray analysis software (on microscopes and multiple off-line copies)</td>
<td>PC</td>
</tr>
<tr>
<td>CrystalMaker, SingleCrystal, CrystalDiffract (Available for download from Software Central)</td>
<td>Mac and PC</td>
</tr>
<tr>
<td>EDAX TEAM software V6/TSL OIM EBSD Suite (on microscope and off-line). Edax Genesis EDS X-ray analysis.</td>
<td>PC</td>
</tr>
<tr>
<td>FEI TEM Imaging &amp; Analysis software (TIA)</td>
<td>PC</td>
</tr>
<tr>
<td>Gatan Digital Micrograph V1 and V2 (on microscopes and multiple off-line copies)</td>
<td>PC</td>
</tr>
<tr>
<td>Image and diffraction pattern simulation programs based on Multislice and Bloch wave methods (public domain and in-house)</td>
<td>PC</td>
</tr>
<tr>
<td>Image J</td>
<td>PC</td>
</tr>
<tr>
<td>JEMS, multiple copies</td>
<td>PC</td>
</tr>
<tr>
<td>muSTEM</td>
<td>PC</td>
</tr>
<tr>
<td>Matlab, Mathematica, IDL</td>
<td>PC</td>
</tr>
<tr>
<td>Monte Carlo simulation of electron trajectories and X-ray production (Casino, WinXray and in-house)</td>
<td>PC</td>
</tr>
<tr>
<td>Oxford AZtec V3.3 EDS and EBSD analysis software (on microscope and multi-seat network licence)</td>
<td>PC</td>
</tr>
<tr>
<td>HKL Channel 5 EBSD Suite (on microscope and off-line)</td>
<td>PC</td>
</tr>
<tr>
<td>HREM software: SmartAlign; Template Matching Module; MSA; FFT-Multislice Simulation Suite</td>
<td>PC</td>
</tr>
<tr>
<td>PDF4 ICDD Crystal Database</td>
<td>PC</td>
</tr>
</tbody>
</table>
### Table 4. MCEM equipment list.

<table>
<thead>
<tr>
<th>Transmission Electron Microscopes</th>
<th>Description: A Shottky field emission transmission electron microscope fitted with spherical aberration correctors on the probe and image-forming lens systems. This instrument is capable of imaging atomic structures with a resolution of less than one-tenth of a nanometre. At the same time, it can acquire chemical information selectively from just one or two atomic columns. The microscope configuration includes electron tomography for three dimensional imaging of structures and an energy imaging filter for composition and bonding measurements.</th>
<th>Technical Configuration: FEG-TEM/STEM; Operates at 80kV, 200kV and 300kV; SuperTWIN pole piece; CEOS CESCOR probe Cs corrector; CEOS CETCOR image Cs corrector; Fischione Instruments 3000 annular dark field STEM detector; FEI DF4/Quadrant DPC STEM detector. FEI DF2/ABF and BF detectors. On-axis Gatan 805 BF/DF detector; Bruker 60 mm² retractable windowless SDD X-ray detector and analyser; Gatan Tridium 683 P image filter; FEI EMPAD direct electron detector (128x128); FEI CETA 16M (4kx4k) CMOS camera; 3-axis piezostage, high stability tomography goniometer; Gatan 636 Double tilt cooling holder; Gatan HCHTR3000 Double tilt He holder; Fischione Instruments 2020 ultra-high tilt tomography holder; Fischione Instruments 2040 Dual-axis advanced tomography holder; Fischione Instruments 2050 on-axis rotation tomography holder; Protochips Aduro/Fusion, 4 channel, Double tilt heating/biasing holder.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEI Titan³ 80-300 FEGTEM (2008)</td>
<td>Description: A high performance Schottky field emission transmission electron microscope with a broad range of techniques and applications. Equipped with electron energy loss spectroscopy (EELS), 3D tomographic imaging, furnace and liquid nitrogen specimen holders, and scanning transmission electron microscopy (STEM) with annular dark field (ADF) detectors.</td>
<td>Technical Configuration: 200 kV; FEG-TEM/STEM; high resolution pole piece; piezo stage; oil free pumping system; Gatan UltraScan 1000 (2kx2k) CCD camera; Gatan 692 Retractable TV camera; Gatan BF/ADF STEM detectors; FEI CETA 16M (4kx4k) CMOS camera; 3-axis piezostage, high stability tomography goniometer; Gatan 636 Double tilt cooling holder; Gatan HCHTR3000 Double tilt He holder; Fischione Instruments 2020 ultra-high tilt tomography holder; Fischione Instruments 2040 Dual-axis advanced tomography holder; Fischione Instruments 2050 on-axis rotation tomography holder; Protochips Aduro/Fusion, 4 channel, Double tilt heating/biasing holder.</td>
</tr>
<tr>
<td>JEOL JEM 2100F FEGTEM (2008)</td>
<td>Description: Suitable for high-end TEM / STEM work on a very wide range of materials science problems ranging from nano-materials, metal alloys, polymers to ceramics and minerals. The Super Twin pole-piece offers high resolution imaging in both TEM (2.4 Å) and STEM (~2 Å) modes whilst remaining easy to use and stable in operation. The Bruker X-Flash X-ray detector has an energy resolution of 123 eV (Mn K). In STEM mode, point, line-scan and area (mapped) X-ray analyses can be obtained at spatial resolution close to 1 nm. The windowless detector offers very high sensitivity for the light elements (B, C, N, O): up to three times more sensitive than a conventional windowless detector.</td>
<td>Technical Configuration: 200 kV; FEG-TEM/STEM; high resolution pole piece; piezo stage; oil free pumping system; Gatan UltraScan 1000 (2kx2k) CCD camera; Gatan 692 Retractable TV camera; Gatan BF/ADF STEM detectors; FEI CETA 16M (4kx4k) CMOS camera; 3-axis piezostage, high stability tomography goniometer; Gatan 636 Double tilt cooling holder; Gatan HCHTR3000 Double tilt He holder; Fischione Instruments 2020 ultra-high tilt tomography holder; Fischione Instruments 2040 Dual-axis advanced tomography holder; Fischione Instruments 2050 on-axis rotation tomography holder; Protochips Aduro/Fusion, 4 channel, Double tilt heating/biasing holder.</td>
</tr>
</tbody>
</table>
or more times greater than an equivalent ultra-thin window detector.

**Technical Configuration:** 200kV; FEG-TEM/STEM; Super-Twin lens; 5-axis compustage; column isolation valves for rapid sample exchange; Fischione Instruments 3000 annular dark field detector; on-axis BF/DF detector; dry pumping system; Orius SCD200D wide-angle CCD camera (diffraction capable); Ultrascan 1000 high-resolution CCD camera; Bruker 30mm\(^2\) 123 eV windowless SDD and Quantax analysis system; single tilting and beryllium (low background) double-tilting analytical sample holders; plate film or imaging plate capability; tomography and low dose acquisition software.

### FEI Tecnai G2 T20 TWIN TEM (2012)

**Description:** The FEI Tecnai G\(^2\) T20 is MCEM’s main training transmission electron microscope (TEM) used for conventional imaging (CTEM), diffraction and microanalysis (EDS) work on a very wide range of materials science problems ranging from nano-materials, metal alloys, polymers to ceramics and minerals. The T20 employs a gun / column isolation valve, making for extremely rapid sample exchanges with the emitter and HT running. Point or area X-ray spectra can be recorded from the sample region under observation allowing for rapid chemical identification of the material.

**Technical Configuration:** 200kV; LaB6 emitter; Twin lens; 5-axis compustage; column isolation valves for rapid sample exchange; Orius SCD200D wide-angle CCD camera (diffraction capable); Orius SC600 high-resolution CCD camera; Bruker 30mm\(^2\) ultra-thin window SDD and Quantax analysis system; single tilting holder; 3-position single tilting holder; beryllium (low background) double-tilting analytical sample holders; plate film or imaging plate capability.

### Scanning Electron Microscopes

#### JEOL JSM 7001F FEGSEM (2008)

**Description:** Excellent analytical microscope capable of large probe currents making it ideal for x-ray mapping and EBSD acquisition. The large specimen exchange airlock and large working distance make this a suitable microscope for analysing tall samples requiring large depth of field.

**Technical Configuration:** FEG; 5-axis stage; IR chamber camera; oil-free pumping system; retractable BSE detector; specimen exchange airlock; cryo-trap; Oxford Instruments AZtec X-ray analysis system and 80mm\(^2\) SDD; Oxford Instruments Nordlys Max\(^2\) EBSD detector.

#### FEI Nova NanoSEM 450 FEGSEM (2012)

**Description:** A high resolution scanning electron microscope with in-lens detectors and advanced optics allowing high contrast imaging at low accelerating voltages. The microscope can operate in both high vacuum and low vacuum environments, enabling the imaging of insulating materials without the need for sample coating. This system is also fitted with a large area SDD x-ray detector allowing for fast x-ray mapping with large count rates.

**Technical Configuration:** FEG; 5-axis stage; IR chamber camera; oil-free pumping system; retractable CBS annular BSE detector; low vacuum imaging; LV-BSE detector (GAD); Helix detector; beam deceleration; in-lens detectors; NavCam; plasma cleaner; cryo-trap;
<table>
<thead>
<tr>
<th>FEI Magellan 400 FEGSEM (2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong> The Magellan 400 FEGSEM is an extreme high resolution (XHR) instrument equipped with a monochromator allowing improved resolution at low accelerating voltages. This system is fitted with a Quickloader sample loading station allowing for fast transfer of samples without compromising the vacuum. Also equipped with a large area SDD x-ray detector, the Magellan can perform fast x-ray mapping with large count rates.</td>
</tr>
<tr>
<td><strong>Technical Configuration:</strong> FEG; 5-axis piezo stage; IR chamber camera; oil-free pumping system; retractable DBS annular BSE detector; retractable STEM3 detector; quick loader; beam deceleration; in-lens detectors; NavCam; plasma cleaner; cryo-trap; Bruker Quantax 400 X-ray analysis system and 30mm² SDD with super light element window (slew).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Focused Ion Beam Microscope</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong> A versatile dual beam system with a Ga ion beam for patterning and milling and electron beam for imaging and analysis. The ion beam may be used to prepare cross-sections, lamellae for transmission electron microscopy and pattern micron-sized prototypes and devices. The microscope can operate in high and low vacuum and environmental modes with a cold stage, enabling the imaging of insulating materials and frozen aqueous specimens. This system is also fitted with a large area SDD x-ray detector and EBSD system allowing for fast x-ray mapping and crystallographic scans. The XuM module permits tomography on a micron scale.</td>
</tr>
<tr>
<td><strong>Technical Configuration:</strong> FEG; Ga FIB; Pt GIS; 5-axis; stage; IR chamber camera; oil-free pumping system; retractable 4-quadrant BSE detector; low vacuum imaging; LV-BSE detector; E-BSE detector; Retractable STEM detector; EDAX Pegasus and TEAM X-ray analysis system and 10mm² SDD with ultra-thin window (UTW); TSL Hikari EBSD system; Kleindiek in-situ and ex-situ lift-out; FEI AutoFIB Application; FEI AutoTEM G2 Application; FEI AutoSlice and View Application; Gatan X-ray ultraMicroscope (XuM) with microtomography stage; Deben peltier coolstage.</td>
</tr>
</tbody>
</table>
### Specimen preparation and support equipment

<table>
<thead>
<tr>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allied Techprep polisher</td>
</tr>
<tr>
<td>Atom probe tip polisher (in-house)</td>
</tr>
<tr>
<td>Branson Sonifier 450</td>
</tr>
<tr>
<td>Buehler EcoMet 3000 grinder-polisher</td>
</tr>
<tr>
<td>Buehler Handimet 2 roll grinder, two units</td>
</tr>
<tr>
<td>Buehler IsoMet slow speed saw</td>
</tr>
<tr>
<td>Beuhler Vibromet 2 vibratory polisher</td>
</tr>
<tr>
<td>Cressington 208 HR sputter coater</td>
</tr>
<tr>
<td>Cressington 208 carbon evaporative carbon coater</td>
</tr>
<tr>
<td>Ditabis Micron image plate reader</td>
</tr>
<tr>
<td>Gatan 601 ultrasonic disc cutter</td>
</tr>
<tr>
<td>Gatan 656 dimple grinder, two units</td>
</tr>
<tr>
<td>Gatan 682 Precision Etching and Coating System (PECS) and Perpendicular Slope Cutting Tool</td>
</tr>
<tr>
<td>Gatan 691 Precision Ion Polishing System (PIPS), two systems</td>
</tr>
<tr>
<td>Gatan 695 Precision Ion Polishing System II (PIPS II)</td>
</tr>
<tr>
<td>Gatan 950 Solarus advanced plasma system</td>
</tr>
<tr>
<td>Leica EM ACE600 coater</td>
</tr>
<tr>
<td>Leica EM UMC7 cryo-ultramicrotome</td>
</tr>
<tr>
<td>Leica M165C stereo optical microscope with digital camera</td>
</tr>
<tr>
<td>LKB KnifeMaker Type 7801A</td>
</tr>
<tr>
<td>Nikon Eclipse Ni optical microscope</td>
</tr>
<tr>
<td>Olympus BX51 stereo optical microscope with digital camera</td>
</tr>
<tr>
<td>Olympus SZX16 stereo optical microscope with digital camera</td>
</tr>
<tr>
<td>Reichert Ultracut S and FCS cryo-ultramicrotome</td>
</tr>
<tr>
<td>South Bay Technology Model 850 Wire Saw</td>
</tr>
<tr>
<td>Struers Accutom 50 precision saw</td>
</tr>
<tr>
<td>Struers Citovac vacuum impregnation unit</td>
</tr>
<tr>
<td>Struers Lavamin specimen cleaning unit</td>
</tr>
<tr>
<td>Struers Lectropol 5 electrolytic polisher</td>
</tr>
<tr>
<td>Struers Tegramin-30 automated polisher</td>
</tr>
<tr>
<td>Struers Tenupol 2, 3 and 5 twin jet electrolytic polishers</td>
</tr>
<tr>
<td>Technoorg-Linda Ltd Co. Gentle Mill 2</td>
</tr>
<tr>
<td>XEI Evactron Zephyr plasma cleaner</td>
</tr>
</tbody>
</table>
EQUIPMENT MANAGERS, ENGINEERS AND TRAINERS

Equipment within MCEM is supported by Equipment Managers, Engineers and Trainers (see Table 5) with the following responsibilities.

The **Equipment Manager** is the staff member who is most familiar with the detailed operation of the equipment.

The **Equipment Engineer** is the staff member with primary responsibility for the day-to-day operation and routine maintenance of the equipment.

An **Equipment Trainer** provides training in use of the equipment.

Table 5. MCEM Staff responsible for specific equipment.

<table>
<thead>
<tr>
<th>Category</th>
<th>Equipment</th>
<th>Manager</th>
<th>Engineer</th>
<th>Trainers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TEM</strong></td>
<td>FEI Tecnai F20 FEGTEM</td>
<td>Timothy Williams</td>
<td>Russell King</td>
<td>TW, EC, RK, MW</td>
</tr>
<tr>
<td></td>
<td>FEI Tecnai T20 TEM</td>
<td>Timothy Williams</td>
<td>Russell King</td>
<td>TW, EC, RK, MW</td>
</tr>
<tr>
<td></td>
<td>FEI Titan FEGTEM</td>
<td>Matthew Weyland</td>
<td>Russell King</td>
<td>MW, LB</td>
</tr>
<tr>
<td></td>
<td>JEOL 2100F FEGTEM</td>
<td>Laure Bourgeois</td>
<td>Russell King</td>
<td>LB, RK, MW, TW</td>
</tr>
<tr>
<td><strong>SEM</strong></td>
<td>FEI Magellan FEGSEM</td>
<td>Xi-Ya Fang</td>
<td>Renji Pan</td>
<td>FB, XF, PM, RP</td>
</tr>
<tr>
<td></td>
<td>FEI Nova FEGSEM</td>
<td>Xi-Ya Fang</td>
<td>Renji Pan</td>
<td>XF, AL, PM</td>
</tr>
<tr>
<td></td>
<td>FEI Quanta 3D FIB/SEM</td>
<td>Amelia Liu</td>
<td>Renji Pan</td>
<td>AL, RP</td>
</tr>
<tr>
<td></td>
<td>JEOL 7001F FEGSEM</td>
<td>Xi-Ya Fang</td>
<td>Renji Pan</td>
<td>RP, XF,</td>
</tr>
<tr>
<td><strong>Sample preparation and support</strong></td>
<td>Techprep polisher</td>
<td>Matthew Weyland</td>
<td>Russell King</td>
<td>MW, TW</td>
</tr>
<tr>
<td></td>
<td>Branson Sonifier 450</td>
<td>Timothy Williams</td>
<td>Russell King</td>
<td>RK, EC, TW</td>
</tr>
<tr>
<td></td>
<td>Buelher Vibromet 2</td>
<td>Xi-Ya Fang</td>
<td>Renji Pan</td>
<td>XF, RP</td>
</tr>
<tr>
<td></td>
<td>EcoMet polisher</td>
<td>Yu (Emily) Chen</td>
<td>Renji Pan</td>
<td>RP, EC,</td>
</tr>
<tr>
<td></td>
<td>Isomet saw</td>
<td>Yu (Emily) Chen</td>
<td>Renji Pan</td>
<td>RP, EC, XF</td>
</tr>
<tr>
<td></td>
<td>Handimetc 2</td>
<td>Yu (Emily) Chen</td>
<td>Renji Pan</td>
<td>RP, RK, EC</td>
</tr>
<tr>
<td></td>
<td>Cressington sputter</td>
<td>Xi-Ya Fang</td>
<td>Renji Pan</td>
<td>RP, JM, XF, EC</td>
</tr>
<tr>
<td></td>
<td>Cressington carbon</td>
<td>Xi-Ya Fang</td>
<td>Renji Pan</td>
<td>RP, JM, XF, RK</td>
</tr>
<tr>
<td></td>
<td>coater</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gatan PECS</td>
<td>Xi-Ya Fang</td>
<td>Renji Pan</td>
<td>RP, XF</td>
</tr>
<tr>
<td></td>
<td>Gatan PIPS</td>
<td>Yu (Emily) Chen</td>
<td>Russell King</td>
<td>RK, EC, TW, MW, RP</td>
</tr>
<tr>
<td></td>
<td>Gatan Disc punch</td>
<td>Yu (Emily) Chen</td>
<td>Russell King</td>
<td>EC, TW, RK, RP</td>
</tr>
<tr>
<td></td>
<td>Gatan Ultrasonic drill</td>
<td>Yu (Emily) Chen</td>
<td>Russell King</td>
<td>EC, TW, RK, MW, PM</td>
</tr>
<tr>
<td></td>
<td>Gatan Disc grinders</td>
<td>Yu (Emily) Chen</td>
<td>Russell King</td>
<td>EC, TW, RK, RP</td>
</tr>
<tr>
<td></td>
<td>Gatan Dimple grinders</td>
<td>Yu (Emily) Chen</td>
<td>Russell King</td>
<td>EC, TW, RK, MW, PM</td>
</tr>
<tr>
<td></td>
<td>Gatan Plasma Cleaner</td>
<td>Matthew Weyland</td>
<td>Russell King</td>
<td>RK, TW, MW, EC, LB</td>
</tr>
<tr>
<td></td>
<td>Gentle Mill</td>
<td>Timothy Williams</td>
<td>Russell King</td>
<td>TW, RK, EC, MW</td>
</tr>
<tr>
<td></td>
<td>Large disc punch</td>
<td>Yu (Emily) Chen</td>
<td>Russell King</td>
<td>EC, TW, RK, RP</td>
</tr>
<tr>
<td></td>
<td>Leica EM ACE600</td>
<td>Xi-Ya Fang</td>
<td>Renji Pan</td>
<td>XF, RP</td>
</tr>
<tr>
<td></td>
<td>Leica M165 C</td>
<td>Amelia Liu</td>
<td>Renji Pan</td>
<td>AL, XF, EC</td>
</tr>
<tr>
<td></td>
<td>NAPCO vacuum oven</td>
<td>Yu (Emily) Chen</td>
<td>Russell King</td>
<td>RP, RK, XF, EC</td>
</tr>
<tr>
<td>Equipment</td>
<td>Operator</td>
<td>Contact Person</td>
<td>Notes</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------------</td>
<td>----------------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>Nikon Eclipse</td>
<td>Xi-Ya Fang</td>
<td>Renji Pan</td>
<td>XF, EC</td>
<td></td>
</tr>
<tr>
<td>Olympus BX51</td>
<td>Yu (Emily) Chen</td>
<td>Russell King</td>
<td>EC, TW</td>
<td></td>
</tr>
<tr>
<td>Olympus SZX16</td>
<td>Yu (Emily) Chen</td>
<td>Russell King</td>
<td>EC, TW, RP</td>
<td></td>
</tr>
<tr>
<td>SEM drying oven</td>
<td>Xi-Ya Fang</td>
<td>Renji Pan</td>
<td>RP, RK, XF, EC</td>
<td></td>
</tr>
<tr>
<td>Glass Drying Cabinet</td>
<td>Xi-Ya Fang</td>
<td>Renji Pan</td>
<td>RP, RK, XF, EC</td>
<td></td>
</tr>
<tr>
<td>Accutom 50</td>
<td>Yu (Emily) Chen</td>
<td>Renji Pan</td>
<td>RP, XF, EC</td>
<td></td>
</tr>
<tr>
<td>Citovac</td>
<td>Xi-Ya Fang</td>
<td>Renji Pan</td>
<td>EC, RP</td>
<td></td>
</tr>
<tr>
<td>Lavamin</td>
<td>Xi-Ya Fang</td>
<td>Renji Pan</td>
<td>EC, RP</td>
<td></td>
</tr>
<tr>
<td>Tegramin-30</td>
<td>Xi-Ya Fang</td>
<td>Renji Pan</td>
<td>EC, RP</td>
<td></td>
</tr>
<tr>
<td>Wire saw</td>
<td>Timothy Williams</td>
<td>Russell King</td>
<td>RK, TW, MW</td>
<td></td>
</tr>
<tr>
<td>Model 850 Wire Saw</td>
<td>Matthew Weyland</td>
<td>Timothy Williams</td>
<td>MW, TW, RK</td>
<td></td>
</tr>
<tr>
<td>Ditibis</td>
<td>Timothy Williams</td>
<td>Russell King</td>
<td>TW, RK</td>
<td></td>
</tr>
<tr>
<td>Lectropol 5</td>
<td>Xi-Ya Fang</td>
<td>Russell King</td>
<td>EC, RK</td>
<td></td>
</tr>
<tr>
<td>Tenupol 3 or 5</td>
<td>Yu (Emily) Chen</td>
<td>Russell King</td>
<td>EC, RK</td>
<td></td>
</tr>
<tr>
<td>Leica UC7 or Ultracut S</td>
<td>Yu (Emily) Chen</td>
<td>Russell King</td>
<td>EC</td>
<td></td>
</tr>
</tbody>
</table>

### Computers

| Computers | Peter Miller | PM |
USING MCEM

Enquiries regarding use of MCEM facilities can be directed to the Manager, Dr Peter Miller.

Projects

The Project is the basis for all work carried out in MCEM and it is essential that you understand this concept. MCEM is required to keep detailed records to meet OHS regulations and to enable preparation of reports required by the University and by Federal, State and other funding bodies. This information is also critical when raising funds to purchase new equipment.

- A Project is a body of work with a specific affiliation and a defined purpose.
- A Project must be closed and a new Project may be created if the Project’s affiliation changes or if there is a significant change in its purpose. A Project may also be closed and possibly a new Project may be created to meet the administrative needs of Supervisors.
- MCEM uses Project Numbers to track use of microscopes and other equipment and for charging.
- The Project Number is needed when making a booking and when filling in logbooks.
- Limits on use apply to the Project, not to the User.
- A Project can have multiple Users and Supervisors and a User can have multiple Projects.
- The User(s), Supervisor(s) and Project may all have different affiliations.
- A User cannot have more than one Project for the same purpose.

Steps to becoming a New MCEM User

1. Fill in the MCEM Project Request Form.
2. Attend a New Project Meeting to determine your microscopy and training needs (your PhD supervisor must also attend).
3. Download and read the MCEM User Manual.
4. Attend an Induction Session.
5. Attend your first training or client session at the scheduled time.

Existing MCEM Users: Change of Project/Material/Additional Training

1. Fill in the MCEM Project Request Form.
2. You will be contacted to discuss changes.

Please note that due to the heavy demand for MCEM facilities and for training, it is very difficult for the Centre to accommodate urgent requests. At times the wait to commence training can exceed one month for the SEMs and TEMs and it may take longer than two weeks before samples can be examined by a MCEM staff member.

New Project meetings are held on the second Tuesday of each month.

Users are normally trained to do their own microscopy, unless the amount of work involved is relatively small, or if the microscopy and interpretation is too complex, in which cases it is more
efficient for MCEM staff to perform the microscopy. This is called a Client Project. The User is expected to be present while their samples are being examined and work by MCEM staff must be appropriately acknowledged.

Occasionally an initial feasibility study may be carried out where there is some uncertainty in the Project, for example, to determine if it is possible to obtain useful information about a sample using MCEM equipment. Depending on the results the Project may not proceed, may proceed as a Client Project or arrangements will be made for the User to be trained.

Please note that due to the heavy demand for access to MCEM facilities and for training it is very difficult for MCEM to accommodate urgent requests. It may be a month or more before training can commence or Client work can be done. In the meantime, if you have urgent microscopy needs, MCEM staff can undertake a limited amount of microscopy on your behalf.

Please also note that you will only be trained if you can make regular use of the microscope over at least the next six months following your training. This is essential to consolidate your skills in operating the microscope following training. As part of your training you must use the microscope at least twice within a few weeks of being granted a licence. Your licence will be suspended if you don’t do this.

The Microscope Manager(s) will contact you to arrange training as determined at the Project meeting.

You must complete an Induction before you can work unsupervised in the building. Inductions are held on the fourth Tuesday of each month.

You will be informed of the next available Induction session. Prior to attending the Induction you must download and read the MCEM User Manual (this document). The Manual (PDF file) can be downloaded from the MCEM web site (http://www.mcem.monash.edu/) or a printed copy can be obtained from the General Office. You must bring this Manual with you to the Induction session.

After completing the Induction you must complete and sign the Safety Induction Checklist And User Agreement on the last page of the Manual.

Note: The User is the person who has the microscope licence. The Supervisor is responsible for authorising the work and for payment of any costs incurred such as for training, consumables, equipment use or the cost of repairing equipment damaged as a result of incorrect operation by the User. The User and Supervisor can be the same person.

**Supervisor’s Responsibility**

The Supervisor of a Project is responsible for authorising the work and for payment of any costs incurred such as for training, consumables, equipment use or the cost of repairing equipment damaged as a result of incorrect operation by a User on this Project.
TRAINING

Your training needs will have been identified during your initial new Project meeting. MCEM instruments can only be used by trained and licensed Users. A range of licence types are available, depending on your skills and needs (see below).

Training sessions will use standard samples and are not intended to yield scientific results.

Electron microscopy encompasses a number of difficult and complex techniques, each of which requires sustained and dedicated learning to master. Depending on the technique, this can take months or years. After you have completed your initial training you must then make regular use of the microscope over a period of some months to reinforce the training. Your training will not commence until you are able to commit the time necessary to reach a basic level of proficiency with the microscope and you have samples ready for examination.

By completing training to business hours level you will attain a standard of skill necessary to undertake basic microscope operations safely and effectively during normal business hours when assistance is available from MCEM staff. After you have been using the microscope for some time, typically at least six months, you may request training for an After Hours licence.

SEM Training

The scanning electron microscope (SEM) training course includes both theory and hands on training. Trainees must complete a 15 minute open book test based on the instrument's user guide before training can start. Trainees will be given two attempts to achieve a pass mark of 80%. This test can be accessed by the Monash MOODLE online system. Training begins with 5 hours of lectures on SEM theory and sample preparation, followed by a 30 minute closed booked test. The pass mark for the theory test is 70% (maximum of 2 attempts possible). Working in groups, there are 2 x 3 hour "hands-on" practical sessions on the microscope which cover basic operation through to optical system alignment. Training continues with 1 hour of one-on-one training, reinforcing the previous work including secondary electron (SE) imaging, back-scattered electron (BSE) imaging and X-ray analysis. A final 1 hour practical test follows.

After successfully completing the practical and theoretical test, a final 1 hour session is booked with the trainer to observe their specific samples and determine the optimal operating conditions. For this reason it is critical that the trainee must have samples ready before the start of the training course.

TEM Training

All new TEM users start with Tecnai T20 TEM training to a Supervised User level, preceded by a 15 minute open book test based on the Tecnai T20 TEM user's guide.

TEM supervised user training begins with two, two-hour lectures introducing the TEM, generally held on a Monday. The "hands-on" training occupies one full day during the same week and incorporates both a written and practical test. Some background reading is also required for the supervised user training and licence. Once licenced, supervised users can request further training to business hours level (independent operation). Business hours TEM training usually requires five two-hour sessions. Both the initial 15 minute and the final written tests are carried out using the Monash MOODLE online system.

Experienced TEM users needing the advanced capabilities available on the JEOL 2100F FEGTEM or Titan FEGTEM can contact the relevant microscope manager to discuss their microscopy needs.
Specimen Preparation Training
MCEM has a wide range of equipment used to prepare samples for scanning electron microscopy and transmission electron microscopy. The specimen preparation techniques that you need will have been identified during your initial interview.

Specimen preparation for microscopy can be a very complex and time-consuming process. The number of training sessions required may range from one or two for the simpler techniques such as sputter coating to eight or more for the more difficult techniques such as electropolishing and ion beam techniques. In some cases, you may need to contact other groups within the University to arrange access to specimen preparation equipment not available within MCEM such as polishing and grinding equipment operated by the Department of Materials Science and Engineering or the School of Earth, Atmosphere and Environment.

Additional Training
After you have completed your initial training and as your work progresses, you may require additional training. This could be in the application of more advanced techniques, in the operation of other microscopes or in the operation of additional specimen preparation equipment. To arrange additional training, please contact the relevant Instrument Manager, see Table 5.

Refresher Training
If you do not make regular use of licensed equipment your licence will lapse and you will not be able to make bookings or use the equipment. The period of time after which your licence will lapse varies and is typically 3 to 6 months depending on the complexity of the equipment. If your licence has lapsed you will need to take refresher training. Please contact the Microscope Manager who will book a session for this refresher training. The purpose of the refresher training is both to ensure that you know how to correctly operate the equipment and also to inform you of any recent changes in operating procedures. Once the refresher training has been completed your licence will be restored and you will be able to make bookings as normal.

Responsibilities
In order for microscope training to be as effective as possible, the following outlines the responsibilities of the Trainer and the Trainee.

Trainer’s Responsibilities
To teach the Trainee how to operate the microscope safely, effectively and without damage.

To instruct the Trainee in the basic principles of operation of the microscope and to teach the Trainee how to perform basic adjustment of the microscope and accessories in order to achieve reasonable performance.

To teach the basic microscope techniques relevant to the Trainee.

To provide advice to the Trainee on optimisation of the microscope’s performance.

Trainee’s Responsibilities
To comply with MCEM and University OHS policies and procedures.

To always seek help if you are unsure of the correct operating procedure or if the equipment is not working properly.

To always follow the Trainer’s instructions on the operation of the microscope.

To take detailed notes.
To learn the theory of microscopy and related techniques by consulting books and the scientific literature. Centre staff can suggest suitable references.

To become proficient in operating the microscope.

**UNDERGRADUATE COURSE PRACTICAL CLASSES**
At least 3 months’ notice is needed prior to commencement of undergraduate course practical classes in order to guarantee availability of equipment and staff. Please contact the Manager to discuss your needs.

**HONOURS AND 4TH YEAR PROJECTS**
Supervisors proposing an Honours or 4th year project that requires use of MCEM facilities must discuss the feasibility of the project with the Manager before the project is offered to a student. There is not sufficient time during an Honours or 4th year project to train the student so the microscopy will need to be done by an MCEM staff member as a Client job or by another MCEM User. Please note that MCEM staff members have limited time available to carry out Client work.
EQUIPMENT LICENCES

MCEM facilities can only be operated by trained and licensed Users. A licence is also needed to make a booking (see Booking Rules). There are a number of different licence types depending on the needs and skills of the User, see below.

All licences will expire at the end of each year and a renewal reminder email will be sent to all Users late in the year. Licences can be easily renewed by clicking a button in the Booking system.

You must regularly use a microscope to maintain your skills. If you do not use a microscope for a period of time, typically around 3 months, your licence will lapse (in the booking system the licence colour will change from black to red). If this happens please contact the Microscope Manager to arrange a training session to refresh your memory of the instrument’s operation and to bring you up to date with any recent changes in operating procedures.

Unless otherwise stated, licences permit use of microscopes between 9:00am and 5:00pm on normal University business days. A list of authorized personnel is displayed outside each laboratory in the Centre. Only authorized personnel may enter a room unsupervised.

Experienced Business-Hours operators can apply to the Microscope Manager for an After-Hours licence.

Licence Types

Waiting: You are in the queue for training. If you expect to be trained on a particular microscope you should check that you do have a Waiting Licence. If not, please contact the microscope manager.

Client: A Centre staff member will operate the microscope for you and unless otherwise arranged you will need to be present to identify the features of interest in your samples.

Training: Under the direct supervision of a Trainer.

Supervised-Use: Under the supervision of a Trainer; Trainer will exchange samples, exchange the camera (TEM), start up and shut down the microscope but you will record your data (9:00am to 5:00pm).

Business-Hours: Unsupervised use during business hours (9:00am to 5:00pm).

After-Hours: Unsupervised use at any time that the University is open.

Trainer: After-Hours licence plus authorised to train Users.

Manager: Trainer licence plus can grant a new licence.
BOOKING INFORMATION AND RULES

Microscopes can be booked through the MCEM web page, see www.mcem.monash.edu/embookings. You must be a licensed User to access the booking system. Users with a Client licence, Training licence or Supervised Use licence can check on bookings but cannot change them. Instrument manuals, training materials and help information is also available on the Bookings page.

Bookings can only be made a limited time in advance, typically two weeks, and there will be a limit on the number of sessions or hours that can be booked within this period. These limits apply to the Project, not to the User. Booking limits will vary from time to time depending on instrument load. Please contact the Instrument Manager if extra sessions are required urgently.

Activities such as repairs and maintenance, undergraduate classes and training of new users are usually undertaken during normal business hours and occasionally this will significantly limit the time available for regular bookings.

Please note that you are charged for the greater of either the booked time or the logged time.

*From time to time you must check 'My Details' to ensure that your user details are correct. In particular, it is essential that your email address is correct. If email sent to you bounces then it will be assumed that you have left Monash University and your licences, projects and access will be cancelled.*

While checking your details on the ‘My Details’ page you may wish to elect to receive an email alert when a microscope becomes available through a cancellation. This gives all people who urgently need microscope time an equal opportunity to take advantage of a cancellation. Please note that the normal booking rules still apply.

At the bottom of the list of your details is a series of check boxes, one for each microscope that you are licensed to operate.

If you tick a box you will automatically be sent an email whenever a booking on that microscope is cancelled.

**Booking Rules**

The equipment in the Centre is in heavy demand. Please observe these simple rules so that we can optimize access for everyone.

You must attend, ON TIME, every session you are booked for, unless there are exceptional circumstances beyond your control (such as illness).

If you are unavoidably delayed in starting a session, you MUST contact the Instrument Manager or one of the Instrument Engineers. Users who fail to notify the Centre of a delay within 30 minutes of their scheduled start time may have their session reassigned to another User. Persistent lateness may result in a reduction or suspension of booking entitlements.

You must fill in the instrument logbook at the start and end of your session. Note any unusual conditions or equipment problems. Report serious problems in writing and in person to the Instrument Manager or Instrument Engineer. Failure to fill in logbooks correctly can result in a reduction in your booking entitlement or licence.

A microscope can only be used by the person who booked it and for work identified by the Project Number.

Bookings are NOT transferable.

You must finish your session on time so that the next user is not inconvenienced.
If instrument time is available you can extend your microscope session outside the booked time (subject to your licence). This actual time used must be recorded in the instrument log book.

**How To Make An Online Instrument Booking**

Log in to the booking webpage at www.mcem.monash.edu/embookings. If you have forgotten your password, select 'Forgotten your password' and follow the prompts. A new password will be automatically emailed to you.

After login, click on the instrument that you wish to book. This will take you to the current week's table of bookings for that instrument.

Click on the desired day/date of your booking.

From the day bookings table, click on the start time of your booking (left-hand column), then select the number of hours for your booking. You must also select your Project Number from the drop-down list (most Users will only have one Project Number). You may also enter a short notation in the 'Other Info' text box. (Note: If you have a Training or Business-Hours licence, you will only be able to book an instrument during normal hours: Monday to Friday 9:00am to 5:00pm on normal University business days).

To complete the booking, press the 'Confirm Booking' button. Your new booking should then appear on the re-displayed day bookings table. An email confirmation of the booking will also be sent to you.

Log out when you have completed your booking.

**How To Cancel An Online Instrument Booking**

After login, select 'Current' bookings and click on the 'View Bookings' button. This will display a list of your current (future) bookings for all instruments.

Click in the 'Action/Cancel' column for the booking to be deleted.

Select the number of hours that you wish to cancel.

To complete the cancellation, press the 'Delete Booking' button.

Your cancelled booking should then be erased from the re-displayed day bookings table. An email confirmation of the cancellation will also be sent to you.

You can cancel a booking at any time up to one day prior to the start of the session. To cancel a booking within one day of the session you will need to contact the Instrument Manager or Centre Manager.

Please note that we expect that a late cancellation will be a very rare event, perhaps once or twice a year. People who make an excessive number of late cancellations may have their booking rights reduced. A log is kept of booking cancellations.
CHARGES

Internal charges

The internal charge rate applies to:

1. all microscope use by Monash staff and students (postgraduate or undergraduate) who are working on internal University projects;
2. all collaborative work with an external researcher intended for publication with a Monash co-author.

There is no charge for undergraduate work (Honours and 4th year projects, prac. classes etc.).

In 2016 the internal charges are $40/hr (booked or logged, whichever is greater) with a cap of $2,500 per Project per calendar year. There is also a one-off charge of $500 for new users requiring training.

There is no additional charge for any subsequent training or assistance or for reasonable use of specimen preparation equipment and consumables but the Centre reserves the right to recover costs where this is deemed necessary. TEM users can purchase tweezers, agate pestle and mortars and approved Cu grids with holey carbon film at cost from the General Office. A basic set of ultramicrotome knives is provided for general use but regular ultramicrotome users may prefer to purchase their own. Users may also need to provide their own diamond saw blades.

There is no charge for a reasonable amount of Client work carried out by a Centre staff member on behalf of a user (other than for microscope time) but the amount of this type of work that can be undertaken is limited.

This internal charge rate represents a small fraction of the real cost of maintaining and operating these multi-million dollar instruments and of the cost of providing expert staff to train and support users. The rate is very heavily subsidised by the University and is comparable or less than that charged by other Go8 universities.

External charges: publicly funded researchers

The charge rate for use of any microscope except the FEI Titan aberration-corrected TEM by an Australian publicly funded researcher is $150/hr (ex-GST). The charge for use of the Titan TEM is provided on a case by case basis.

There is an additional charge of $100-$150 per hour for staff time (ex-GST).

External publically funded research undertaken in collaboration with a Monash partner and intended for publication with a Monash co-author may be charged at the internal rate.

External charges: commercial entities

Monash University must charge full commercial rates for work done by or on behalf of commercial entities under the Trade Practices Act administered by the Australian Competition and Consumer Commission (ACCC) (see the Australian Consumer Law Compliance Guide, http://intranet.monash.edu/legal/aclguide.html). External commercial work will require costing, a contract and a separate Project Number. External industry Users should contact the Manager to discuss their microscopy needs.

Please note that negotiations for external work can be very involved and time consuming, particularly when intellectual property rights are involved. Undertaking external work at the internal charge rates may be both a breach of University policy and illegal under Trade Practices Act administered by the ACCC. Monash Users who need to undertake microscopy on
behalf of an external client must discuss this with the Manager well in advance of when they plan to start the work.

PUBLICATIONS AND ACKNOWLEDGEMENTS

Your use of Centre facilities is heavily subsidised by the University and by grants from external funding agencies. In order to comply with current funding obligations and to apply for new funding, the Centre must report on the number and type of publications produced by Users of the Centre. It is essential that you, the User, provide us with this information, so that we can continue to provide the advanced instrumentation, staff, training and assistance that you and other researchers require to undertake your research work. It is a condition of use of the Centre that:

1. You provide the reference for all publications and reports that contain results obtained using Centre facilities, including instrumentation, computer software and staff advice;
2. You acknowledge the Centre and any assistance provided by Centre staff in the publication or report;
3. Centre staff members who have acquired and/or interpreted data on your behalf should be invited to be co-authors on the publication, as is usual practice.

Please acknowledge the contributions of the Centre in your publications simply by including:

Where Centre staff provided assistance (but not enough to justify co-authorship):

“The authors acknowledge use of the facilities and the assistance of NAME OF MCEM STAFF MEMBER(S) at the Monash Centre for Electron Microscopy.”

OR

Where you carried out all the work or one or more MCEM staff members are co-authors:

“The authors acknowledge use of facilities within the Monash Centre for Electron Microscopy.”

In addition, specific instruments funded by the ARC (as listed in Table 6) must be acknowledged as follows:

“This research used equipment funded by Australian Research Council grant(s) (select from table below).”

OR

“This research was supported under the Australian Research Council's Centres of Excellence funding scheme (COE for Design in Light Metals).”

Table 6. MCEM instruments funded by the ARC

<table>
<thead>
<tr>
<th>Instrument</th>
<th>ARC Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEI Titan</td>
<td>LE0454166</td>
</tr>
<tr>
<td>FEI Quanta 3D FIB</td>
<td>LE0882821</td>
</tr>
<tr>
<td>FEI Tecnai G2 F20 S-TWIN FEGTEM</td>
<td>LE110100223</td>
</tr>
<tr>
<td>Delmic SPARC Cathodoluminescence system</td>
<td>LE140100104</td>
</tr>
</tbody>
</table>

Publication references must be sent to Katherine O'Rourke (see Contact Details). It would also be appreciated if a soft and/or a hard copy of the publication is provided, which we will place on a publication rack.
MICROSCOPE CALIBRATION AND CHARACTERISATION

It is the responsibility of the user to ensure that the microscope is fit for purpose and to carry out any calibration or characterisation measurements necessary for their work.

Electron microscopes are capable of achieving remarkable magnification, up to several million times for a transmission electron microscope (TEM) and around half a million times for a scanning electron microscope (SEM). However, at best the accuracy of the indicated magnification or camera length will be 1%, more typically 5% and in some circumstances worse than 10%. It is difficult to calibrate an SEM above 50,000 times magnification as there are no suitable standards.

Electron microscopes can be operated under a very wide range of conditions, for example, the user can vary the accelerating voltage, beam current, magnification and focus. It is not possible to calibrate the microscope under all possible operating conditions. The calibration is done at a few fixed settings and the microscope then estimates the magnification at other settings by interpolation.

The accuracy of the magnification calibration at the fixed settings is usually about 2%. Note that for a scanning mode the X magnification and Y magnification are calibrated independently and so will be a little different, and that the angle between the X and Y scan directions may not be exactly 90 degrees. A scanning microscope also makes complex calculations to correct the beam position for image rotation caused by changing the strength of focussing lenses. This ensures that the X and Y beam scan directions are close to the X and Y stage movement directions. The microscope must make dynamic magnification, focus and scan rotation corrections when observing a highly tilted sample such as for EBSD. The image of a tilted sample is likely to suffer from very severe distortion and to be out of focus in places.

A TEM is often fitted with more than one camera and each camera will have a slightly different calibration.

In addition to magnification there are many other important microscope parameters, some of these are listed below

- Magnification/camera length
- Focus (SEM working distance)/defocus (TEM)
- Image distortion/linearity
- Accelerating voltage
- Beam current
- Resolution/probe size
- Rotation between diffraction pattern and image
- Convergence angle
- Acceptance angle for detectors
- Energy calibration of detectors (EDX, EELS, CL…)
- X-ray analysis standards
- Dark current and flat field corrections for cameras
- Detector sensitivity
- Stage temperature
- Rotation between X and Y scan directions and X and Y stage movement directions

The relevant microscope manager can provide advice on calibration and characterisation of particular microscope parameters.
STORAGE OF MATERIALS AND DATA, COMPUTING

Storage of samples and materials
Centre Users are not permitted to store samples or other materials in the building. The Centre operates on a "Carry-in/Carry-out" basis. It is assumed that anything left behind is not needed and after one week these materials will be disposed of.

Samples and sample preparation materials labelled with the User's name, telephone number, date and composition (where necessary) can be left in designated areas within the specimen preparation laboratories for short periods while samples are actually being made. Users are not permitted to store and samples or other materials within the building.

The Centre can assist you if you need to store your samples under special conditions, for example, vacuum or inert gas.

Computing
You MUST NOT install any software on Centre computers. If you need to use a program that is not currently installed please contact the Centre Manager to discuss this. It may be possible to have the software installed.

Computer Room computers are provided to allow Users to process their data. They are not general use computers.

Access to some special-purpose Computer Room computers is restricted.

You are not permitted to use TeamViewer or any similar software running on a Centre computer to remotely access an external computer.

If required TeamViewer can be used to remotely access a Computer Room computer to monitor long term calculations. Please contact the Centre Manager if you need to do this.

Laboratory computers are only to be used for instrument control, data acquisition, processing and transfer. Web browsing, Authcate login and use of TeamViewer or similar programs is not permitted.

The photocopier/printer may only be used for MCEM-related printing.

USB Devices
Use of USB memory sticks, external USB drives or similar devices is NOT permitted on MCEM computers as these are a source of virus infection. A number of computers are not protected by virus checkers as the manufacturer will not guarantee equipment performance if any additional software is installed. Computers without virus checkers are not connected to the network.

Data storage and transfer
Storage and security of your data is your responsibility.

Data can be lost at any time due to hardware failure, software upgrade or fault or user error.

In general, you should not leave your data on Centre computers. However, in some circumstances where you need access to your data during subsequent microscope sessions or for data processing files can be left on a Centre computer.

Each microscope Support Computer and Computer Room computer has a local `Shared_Data` or `UserData` folder in which you may create a sub-folder for your temporary use. The sub-folder name must be your first name or initial and surname followed by your Project Number so that we can identify the owner of the data, for example: ‘Peter Miller 10033’.
Folders not conforming to this format or created elsewhere including the desktop will be deleted. Please delete all of your data from Centre computers when it is no longer needed.

A new data folder is created each year and data from previous years may be deleted to free up storage. It is up to you to move any data that you wish to keep into the current year’s folder.

As mentioned above, USB devices are not permitted. You can write your data to DVD or CD or you can transfer your data to your computer via the shared N: drive, see instructions on the MCEM web page at:


Rules of use for the shared network (N:) drive:

1) The shared network drive is only to be used for transfer of data generated within MCEM between an MCEM computer and your computer.

2) Each microscope has its own folder on the N: drive where you can create a sub-folder to hold your data. The sub-folder name must be your first name or initial and surname followed by your Project Number so that we can identify the owner of the data, for example: ‘Peter Miller 10033’. Folders that do not conform to this format will be deleted.

3) The shared network drive must not be used for long-term data storage. Please note that files on this drive are accessible to all MCEM users (around 400+ people) and potentially to anyone in the university. These files are not secure or confidential and an unintentional or deliberate act could result in the loss or corruption of some or all of this data. The shared network drive may also contain virus software.

4) All files on the shared network drive are considered to be temporary; it is your responsibility to ensure that you have secured your data. The N: drive is deleted at the end of each year.

Penalties may be imposed for failure to follow rules on storage and use of computers.

MICROSCOPE LABORATORY DOORS

All microscope laboratory doors must be kept closed for the following reasons:

- TEMs and older SEMs are operated with subdued or no lighting;
- To ensure thermal stability of microscope rooms. (Microscope laboratories have special designs to enable better than 0.1°C/hour to optimise microscope performance);
- To keep out dust. (Microscope laboratories have special air flows and filters to minimise dust in order to protect the microscope and your specimens);
- To provide acoustic isolation to prevent degradation of microscope performance by outside noise.

Room in use light

While you are using a microscope you should turn on the ‘Room in Use’ light.

If the ‘Room in Use’ light is on you must knock before entering a room and wait to be admitted. The microscope rooms have very good acoustic shielding and so you often will not be able to hear the microscope User’s reply to your knock. If the microscope User does not open the door, you may not enter.

It is very important that you turn off the ‘Room in Use’ light at the end of your session.
SAFETY RULES AND LABORATORY PROCEDURES

The Safety Rules and Laboratory Procedures comprise part of the MCEM Safety Induction that all Users are required to complete. Note that these are the general rules and procedures applying to all people using the Centre. You will be instructed in any additional rules and procedures that apply for specific items of equipment as part of your training.

For information regarding OHS Risk management at Monash University, see the Monash OHS Web Page: [http://www.monash.edu/ohs/index.html](http://www.monash.edu/ohs/index.html)

Where any hazard was identified with either your samples or the sample preparation methods to be used, a Risk Control Worksheet (RCW) must be prepared by the User and signed by the User, Supervisor and Instrument Manager (see Table 5).

If a hazard has been assessed, and, after taking into account all normal methods of risk minimization, the risk is still medium or high, then a Safe Work Instruction (SWI) must be prepared by the User if a suitable SWI has not already been prepared (Note: an SWI may also be called a Safe Working Procedure).

All RCWs and SWIs with risks that remain as medium or high must be checked and counter-signed by the Safety Officer or Deputy Safety Officer.

Materials Safety Data Sheets (MSDS) are downloadable using ChemWatch.

Failure to comply with MCEM Rules and Procedures may result in a penalty being imposed. Penalties include warnings, reduction in licence level, temporary loss of licence, permanent loss of licence and permanent loss of access to MCEM.

OHS Induction

Monash staff, students and long term visitors who need to carry out unsupervised work in laboratory areas (you will have a Monash ID card)

You must have already completed two inductions: 1) the Online OHS induction ([https://my.monash.edu/services/training/ohs](https://my.monash.edu/services/training/ohs)) and 2) your Department's or School's the Local Area OHS induction.

In order to work in MCEM laboratory areas without immediate supervision you must complete the following MCEM inductions:

1. MCEM Induction (MCEM Manual);
2. LOCAL AREA OHS INDUCTION - STAFF, HONOURS OR POST-GRADUATE INDUCTION CHECKLIST for work in MCEM;
3. If necessary, LOCAL AREA OHS INDUCTION CHECKLIST - LABORATORY, WORKSHOP OR STUDIO INDUCTION for work in MCEM.

See also Computer room only users

In order to work in MCEM computer room without supervision you must complete the following MCEM induction:

1. LOCAL AREA OHS INDUCTION - CONTRACTORS OR VISITORS INDUCTION CHECKLIST for work in MCEM.

You are not permitted to use any equipment in MCEM other than computers in the computer room and you must be under supervision while in laboratory areas.
Visitors or client users under supervision at all times

1. Short MCEM Induction.

You are not permitted to operate any MCEM equipment and you must be under supervision while in laboratory areas.

Contractors working under supervision at all times

1. Short MCEM Induction.

Buildings and Properties staff and contractors

Buildings and Properties will arrange inductions for Buildings and Properties staff and contractors.

Visitors and contractors who need to carry out unsupervised work in laboratory areas (you will not have a Monash ID card)

Contractors must first complete the Monash Contractor Induction Program provided by the Buildings and Property Division (formerly Facilities & Services), see http://www.monash.edu/contractors/contractor-induction.

Computer room only users

In order to work in MCEM computer room without supervision you must complete the following MCEM induction:

1. LOCAL AREA OHS INDUCTION - CONTRACTORS OR VISITORS INDUCTION CHECKLIST for work in MCEM.

You are not permitted to use any equipment in MCEM other than computers in the computer room and you must be under supervision while in laboratory areas.

Additional OHS training

Depending on the nature of your work you may need to complete additional training and inductions, for example:

1. LOCAL AREA OHS INDUCTION MODULE - CRYOGENIC FACILITY INDUCTION CHECKLIST plus online and in-house training.

2. Electropolishing training.

3. After hours access training.

Induction checklists and further information can be found at http://www.monash.edu/ohs/ohs-training-and-induction/ohs-induction/local-area-ohs-induction.

General Rules

If in doubt, always seek help!

You must comply with any temporary notices or tags that may be used from time to time in the Centre. For example, Do Not Operate notices and warnings of changed operating conditions due to equipment faults.

You may only operate equipment for which you hold a valid licence.

Doors and emergency exits must be kept clear.

Do not tamper with fire extinguishers, first aid kits and other emergency equipment.
Children are not permitted in any laboratory, except under supervision on Open Day.
No running in the building.

The Centre is equipped with very sensitive smoke and fire detectors. Any work that may generate smoke or dust must be carried out in a fume cupboard.

With effect from 1 January 2016, Monash is a smoke-free University.

A list of authorized personnel is displayed outside the computer room and each laboratory and utility room in the Centre. Only authorized personnel may enter a room unsupervised.

**After-Hours Operation**

MCEM Business Hours are between 8:45am to 5:30pm on normal university working days.

The University is closed Christmas to New Year and only approved Centre staff members may enter the building during this period.

People in the building outside Business Hours must have After Hours access or must be under the direct supervision of someone with After Hours access.

An After-Hours licence is required to use equipment outside normal Business Hours.

Tenupol Electropolishing, First Stage Atom Probe Electropolishing, and Cryogenic Microtoming are classed as hazardous procedures that are not allowed to be undertaken outside normal Centre business hours.

**Security Procedure**

An additional After Hours security procedure applies:

- Between the hours of 8:00pm and 7:00am on normal University working days;
- Anytime on weekends or university holidays.

All people in the building during this period must fill in the After-Hours Logbook in Reception and must ring Security (53059) on arrival and departure.

In the event of a fire alarm after hours, make the equipment safe (if safe to do so) and evacuate the building on the first fire alarm (Orange light, Beep-Beep alarm). Do not re-enter the building until you are advised that it is safe to do so by a University security staff member or Centre staff member.

**Personal Protective Clothing And Equipment**

Closed footwear must be worn in all laboratories.

Additional Personal Protective Equipment (e.g. laboratory coats, long trousers, protective aprons, safety glasses, full-face safety visor, gloves…) must be worn wherever indicated.

Two colours of disposable nitrile glove are provided in laboratories: Black and Blue.

Black gloves are worn for your protection when handling hazardous materials such as electropolishing solutions, solvents or other chemicals. These gloves must be removed and disposed of before you leave the room. Do not touch door handles or any other communal items while wearing gloves that may be contaminated.

Blue gloves are used during the final stages of sample preparation and when handling items that will go into the microscope vacuum such as sample holders. Blue gloves do not have to be removed when you leave the room as you may need to carry a sample between the sample preparation room and the microscope room.
Leather gloves are available for processes involving liquid nitrogen, and are not under any circumstances to be used for handling chemicals.

Personal protective clothing and equipment must not be worn in office areas or meals areas. Personal protective equipment (PPE) zones in Specimen Preparation Laboratory G35 are indicated by the yellow tape markings on the floor. All work completed within these zones requires the use of lab coats, safety glasses and gloves. There are a number of lab coats and safety glasses provided at both entry points for your convenience. Please do not bring external lab coats from your department into this lab, unless by prior arrangement.

**Laboratory Use**

No food or drink may be stored or ingested in any laboratory.

Equipment logbooks must be filled in at the start and end of a session. Note any unusual conditions or equipment problems and report these to a Centre staff member.

You must follow the Operating Procedures provided with each piece of equipment and you must comply with all Laboratory Operating procedures.

Access to the electropolishing room is restricted by proximity card access and is strictly limited to licensed Users of electropolishing equipment and trainees under direct supervision.

Never attempt to repair any equipment. Any problems, faults, or unusual behaviour must be reported in sufficient detail in the logbook and to a Centre staff member. Names of Centre staff members responsible for laboratories can be found on the Laboratory Protocol sheets. Names of Centre staff members responsible for equipment can be found in Operating Procedures and in Table 5.

No items of equipment, tools or consumables can be removed from the room in which they belong without the permission of a Centre staff member.

Clear and clean your work area when finished. Glassware must be cleaned by the User immediately after use and must not be removed from the Centre.

Samples and sample preparation materials labelled with the User’s name, telephone number, date and composition (where necessary) can be left in designated areas within the specimen preparation laboratories for short periods while samples are actually being made.

It is assumed that anything left behind is not needed and after a short grace period, these materials will be disposed of.

Keep benches, sinks, and fume hoods clean and clear of clutter.

If equipment is not functioning as you expect, seek help!

**Fume Cupboards**

Work with the sash only open far enough to perform the procedure comfortably.

Do not leave any unnecessary glassware, chemicals, equipment in the fume cupboard.

Never use a fume cupboard if the extraction fan or backwash are not working. Report any faults immediately to a Centre staff member.

Samples And Chemicals

The Centre’s standard procedures for handling and preparing samples are only suitable for non-hazardous materials. If your samples are hazardous or may produce hazardous materials during sample preparation you must mention this at the new Project meeting. Centre staff can assist you with developing safe work procedures for your materials.

Examples of hazardous materials include:

- Carbon fibres
- Nanoparticulates and nanofibers
- Samples containing toxic elements such as As, Be, Cd, Hg, Pb, TI
- Samples containing radioactive materials such as Ra, U, Th
- Any sample containing biological material

Materials Safety Data Sheets (MSDS) for each chemical stored or used in a laboratory are kept in the master MSDS folder located in room G35 or can be assessed online using ChemWatch from the computer located in Rooms G35. Ensure that you read the MSDS for all chemicals used by you and prepare Risk Control Worksheets and Safe Work Instructions as required. A glossary of terms used in the MSDS forms is located in each folder.

Only those chemicals listed for each laboratory in the front of the master MSDS folder may be stored or used in the Centre.

You must have carried out a Risk Assessment for your work (see [www.monash.edu/ohs/forms/risk-management-program.pdf](http://www.monash.edu/ohs/forms/risk-management-program.pdf)) and you must inform MCEM of all Risk Phrases and/or Safety Phrases associated with each material that you intend to bring into MCEM, whether the material is a sample or is used for sample preparation. Users MUST NOT bring any chemicals into the laboratory without permission. Permission must be sought from the Safety Officer, Dr. Russell King or the Deputy Safety Officer, Dr. Peter Miller, before any new chemical may be introduced into a laboratory. The Centre will arrange for the supply and disposal of chemicals used for sample preparation.

Store all chemicals in the appropriate cabinet.

Segregate different classes of chemicals (refer to MSDS for class).

Label all chemicals, reagents, samples and wash bottles. Labels on working solutions and preparations must include the chemical composition and product name, the preparation date, expiry date (if appropriate) and the owner’s name and telephone number.

Waste solvents and expired washing methanol in G37 are to be placed in a 10L waste solvent container in the G37 flammable storage cabinet.

Waste solvents in G35 are to be placed in the 2.5L waste solvent container in the G35 flammable storage cabinet.

The following chemicals are strictly BANNED from the Centre.

- Hydrofluoric Acid
- Perchloric Acid/Acetic Anhydride mixes
- Nitric Acid/Ethanol mixes

Electropolishing solutions are potentially explosive and must be handled under highly controlled conditions to minimize the risk of explosion. (Several deaths have been reported worldwide from...
exploding solutions. Only licensed electropolishers are permitted to handle the electropolishing solutions and washing methanol that are stored in G37.

Access to the electropolishing room G37 is by Proximity Card and is strictly restricted to licensed electropolishers and trainees under direct supervision.

**Engineered Nanoparticles (ENPs)**

There is very little information on the safety of ENPs but as some of them will be dangerous to health the best practice is to treat all ENPs as toxic substances unless a specific nanoparticle MSDS is available.

The most dangerous ENPs are likely to be those that are not soluble in water. They cannot be eliminated from the body and therefore have a very long biological persistence. Carbon nanoparticles and most metal oxides fall into this category. Studies of carbon nanotubes have shown that some of them have dimensions that are similar to asbestos fibres and produce similar effects under experimental conditions.

Materials that are not hazardous on the micron scale may prove to be hazardous as nanoparticles due to their novel properties. Gold is an example of an ENP with novel properties. Although gold in its bulk form is unreactive, gold nanoparticles in the 2-5 nm size range are highly chemically reactive. MSDS sheets for the bulk material may therefore be unreliable, hence the need for specific MSDS that relate to the nanoparticulate form.

For hazardous substances the high surface area and number density of the ENP form may mean that safe exposure limits based on weight may not be appropriate.

Inhalation, ingestion, and permeation through damaged skin or wet membranes (ie eyes) are the most likely routes into the body.

**Handling ENPs**

Dry ENPs must be handled inside a fume cupboard to prevent inhalation.

Gloves and safety glasses must be worn when handling dry or liquid suspensions of ENPs to prevent skin or eye contact.

**Emergency Stop Buttons**

Laboratories G30, G31, G35 and G37 are fitted with an Emergency Stop button. Pressing this button will cut all power to GPOs in these five rooms. Fume cupboards are also fitted with Emergency Stop buttons that will cut power to that fume cupboard.

**UPS Power**

All microscope power outlets and power outlets for water chillers in Utility rooms are supplied from uninterruptible power supply (UPS) units located in the electrical plant room. Red general power outlets (GPOs) in microscope rooms and in the General Office are also connected to UPS. UPS power is provided in the Research Fellows Office for the Communications Rack (two outlets at high level) and to the floor box closest to the communications rack.

**SF₆ Sensors And Alarms**

All TEM microscope laboratories are fitted with SF₆ sensors and alarms. If an alarm sounds, leave the room and advise a Centre staff member of the alarm. If an SF₆ alarm is operating, you must not enter the laboratory.
**Oxygen Sensors And Alarms**

Laboratories G30, G31, G35, G37 and G38 are fitted with oxygen sensors and alarms that will operate if the oxygen level drops below 19.5% (normal reading ~20.9%). If a low oxygen level alarm sounds, leave the room and advise a Centre staff member of the alarm. If an Oxygen alarm is operating, you must not enter the laboratory. Oxygen levels can be monitored remotely on the control panel in Communications Duct Room G46A.

**Liquid Nitrogen**

Liquid nitrogen (LN\(_2\)) is a cryogenic liquid and is the liquefied form of nitrogen gas. The major hazards from LN\(_2\) as used in the Centre are cold burns (boiling point -196 °C), asphyxiation (gaseous nitrogen can displace oxygen from the air) and pressure build-up (liquid to gas expansion ratio 790 times). People needing to use LN\(_2\) must first complete the LOCAL AREA OHS INDUCTION MODULE - CRYOGENIC FACILITY INDUCTION CHECKLIST plus online and in-house training. For further information of handling and storage of liquid nitrogen see http://www.monash.edu/ohs/information-and-documents/all-information-sheets/handling-and-storage-of-liquid-nitrogen.

Liquid nitrogen is used in many parts of the Centre.

Liquid nitrogen can cause severe burns and the eyes are particularly vulnerable.

Always wear the apron, full-face visor, insulating gloves and closed footwear when filling transfer containers from the liquid nitrogen storage vessels or when transferring and pouring liquid nitrogen from the transfer containers. Runners with mesh uppers and sandals are not acceptable when handling liquid nitrogen.

Never handle liquid nitrogen whilst wearing disposable gloves.

Liquid nitrogen boil-off can displace oxygen so there is a risk of asphyxiation – minimize spillage and decant in well-ventilated areas. The 160ltr Dewar must not be stored or used anywhere other than the Gas Store (Room G38), which has direct external ventilation.

Thermal shock can cause materials to fracture: only use the stainless steel or Nalgene Dewars provided, or Dewars provided by equipment manufacturers to handle liquid nitrogen.

As liquid nitrogen gasifies, there is a large volume increase – never store liquid nitrogen in sealed vessels.

Liquid nitrogen must not be removed from the Centre.

Be aware that liquid nitrogen will cause liquid oxygen to form on cold surfaces by condensation from the atmosphere.

**Compressed Gases**

The following compressed gases are used in the Centre:

- Nitrogen
- Argon
- Sulphur hexafluoride
- Helium
- Neon
- Oxygen
- Hydrogen
- Argon/Oxygen
- Natural Gas
All microscope rooms and most laboratories have reticulated nitrogen supplies. There is an asphyxiation hazard if there is a major nitrogen leak and the air conditioning is not operating, for example, during a power failure.

YOU MUST NOT ENTER OR REMAIN IN THE BUILDING WHILE THE AIRCONDITIONING IS INOPERATIVE.

Note:
Gas isolation taps are located outside the gas store.

There is an alarm panel above the gas isolation taps. This alarm warns of low gas pressure indicating that a gas bottle needs changing or low nitrogen pressure; this is not a hazard alarm.

Keep gas cylinders secured in their racks.

Do not move or perform maintenance on gas cylinders, regulators or other gas fittings.

**Hazards And Incidents/Chemical Spills/Breakages**

Any occurrence that leads to or potentially leads to injury or danger to health must be reported to the Safety Officer, Dr Russell King or the Manager/Deputy Safety Officer, Dr Peter Miller. A Hazard and Incident Report must be submitted online to the Safety Analysis and Risk Analysis Hub (SARAH), see http://www.monash.edu/ohs.

Chemical spill kits are located in rooms G35, G37 and corridor G48 (East corridor).

Chemical spills requiring clean-up are classified as Incidents and must be reported immediately to the Safety Officer or Manager/Deputy Safety Officer.

Spills involving electropolishing solutions require special cleaning procedures detailed in the “Safe Working Procedures” for electropolishing solutions and must be handled by licensed electropolishers or members of the Breathing Apparatus (BA) team. Report any spill immediately to the Safety Officer or Manager/Deputy Safety Officer. Licensed electropolishers may only clean up minor spills less than 50 ml. Larger spills must be cleaned up by the Breathing Apparatus team.

Broken glass must be disposed of in the broken glass containers.

**Ionising radiation**

The interaction of electrons with matter produces ionising radiation in the form of X-rays within scanning and transmission electron microscopes. Microscope and accessory manufacturers design their equipment to limit emission of X-rays to safe levels. Microscopes and accessories are measured for X-ray leakage by the manufacturer and measurements are made at installation. MCEM has radiation monitoring equipment and microscopes are checked for leakage at installation and after any significant change to the microscope’s configuration.

An electron microscope is not classed as “ionising radiation apparatus” for the purpose of the Victoria Government Radiation Act 2005, see Victoria Government Gazette No. S 207 Friday 31 August 2007 (see [Declaration that certain material and apparatus are not radiation sources](https://www2.health.vic.gov.au/getfile/?sc_itemid=%7bB1CBBC78-D0C3-42FC-AC99-418F58ACFFED%7d&title=Declaration%20that%20certain%20material%20and%20apparatus%20are%20not%20radiation%20sources)).
EMERGENCY EVACUATION

Evacuate the building on hearing or seeing any alert or evacuation alarm:

- ALERT tone (Beep Beep …) or seeing the flashing orange ALERT light;
- EVACUATION tone (Whoop Whoop ….) or seeing the flashing red EVACUATION light.

If safe to do so, put the equipment into a safe state, for example, close column isolation valve.

Close but do not lock office/laboratory doors as you leave.

Leave the building by the nearest safe exit. If after hours and safe to do so fill in the log book as you leave so that emergency services know that you have left the building.

Proceed to the ASSEMBLY AREA which is to the East of 15 Innovation Walk (Building 75), see Figure 4.

Follow instructions given by Floor Wardens (Yellow Hats).

Remain at the ASSEMBLY AREA until a Warden or their delegate gives the ALL CLEAR or you are given directions by Monash Security staff or an emergency worker.

Power Failure

Microscopes are powered by Uninterruptible Power Supplies (UPS) backed up by a generator and will continue to operate in the event of a power failure. However, all other services such as general power outlets, lighting, network, telephones and air conditioning will fail. Emergency torches are provided in microscope rooms.

In the event of a power failure lasting more than about one minute you should put the equipment into a safe state (for example, close column isolation valve) and leave the building. You must not re-enter the building until a Centre staff member advises you that it is safe to do so.

YOU MUST NOT ENTER OR REMAIN IN THE BUILDING WHILE THE AIRCONDITIONING IS INOPERATIVE (see Compressed Gases).
IN AN EMERGENCY

Contacting emergency services
If emergency services (Ambulance, Police, Fire Brigade) need to be contacted:
immediately dial 000 from your mobile telephone or
dial 0000 from a university telephone with access to an outside line (Foyer and Specimen Preparation Laboratory G35).
The decision of calling emergency services is at the discretion of the person confronted with the situation. State:

- Nature of Emergency
- Location - 10 Innovation Walk (Building 81)
- Nearest room number
- Your name

Once the required emergency service has been notified, Monash Security must be contacted on 333 for notification in order that the emergency services can be escorted to the scene by security staff in a timely manner.

Further information can be obtained from the Emergency Procedures booklets that have detailed information on emergency response procedures including injury protocols. You should make yourself aware of the processes in these booklets which are next to every internal phone.
The Monash Security website http://www.fsd.monash.edu/security also is an excellent source of information

For less urgent matters you can ring the Gate House on 53059.

Fire Extinguisher Locations
Room G38 (Gas Store)
Room G10 (Tea Room)
Corridor outside Room G20 (FEGTEM Operators Room)
Corridor opposite Room G38 (Gas Store)
Corridor outside Room G43 (next to FEI Magellan SEM Room)
Fire system cupboard in Room G02 (Entrance foyer)
Inside Fire Hose Reel cupboard next to mezzanine tea point
Room 110 (Research Fellows’ Office)

Emergency Eye Wash And Showers
There are Eye Wash Stations and Emergency Showers in Rooms G27, G35, and G37.
Emergency Evacuation Plan

Figure 4. Emergency evacuation plan.


Safety Officers

![Safety Officer](image1)
Dr Russell King  
Building 81, Room G34  
Tel.: 990 53804.

![Deputy Safety Officer](image2)
Dr Peter Miller  
Building 81, Room G06  
Tel.: 990 55291.

Health and Safety Representative
Katherine O’Rourke

Building Wardens
Peter Miller (Building Warden)  
Russell King (Deputy Building Warden)

Fire Wardens
Assoc. Prof. Laure Bourgeois  
Dr Emily Chen  
Dr Xi-Ya Fang  
Dr Amelia Liu  
Mr Renji Pan  
Assoc. Prof. Matthew Weyland

Breathing Apparatus
Mr Renji Pan  
Dr Russell King  
Dr Xi-Ya Fang
First Aid Officers

First Aid kits are located in Rooms G03 (General Office), G10 (Kitchen) and G35 (Specimen Preparation Laboratory A).

The following MCEM staff members are qualified as Monash Level 2 First Aiders:

Figure 7. Dr Tim Williams
(First aid co-ordinator)
Building 81, Room 103
Tel.: 990 20721

Figure 8. Dr Russell King
Building 81, Room G34
Tel.: 990 53804.

Figure 9. Dr Xi-Ya Fang
Building 81, Room 104
Tel.: 990 20821

Figure 10. Dr Amelia Liu
Building 81, Room 106
Tel.: 990 58789
Nearest Medical Health service

The Monash University Medical Health Service clinic is located on the Clayton campus at 21 Chancellors Walk, Ground floor (see Campus Map Figure 1), tel. 990 53175.
<table>
<thead>
<tr>
<th>Version no.</th>
<th>Date of Issue</th>
<th>Reviewed by: name</th>
<th>Amendments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>06/10/2016</td>
<td>PRM</td>
<td>Created (Previously MCEM Manual 2016 version 2.25_PRM.pdf)</td>
</tr>
<tr>
<td>2</td>
<td>21/01/2019</td>
<td>PRM</td>
<td>Reviewed and updated</td>
</tr>
</tbody>
</table>